

Railway Maintenance Engineer

Volume 17

CHICAGO—JULY, 1921—NEW YORK

Number 7

IN LAYING RAIL

You Spend Money to Provide for Expansion
Is It Worth Anything to HOLD It?

THE P & M CO.

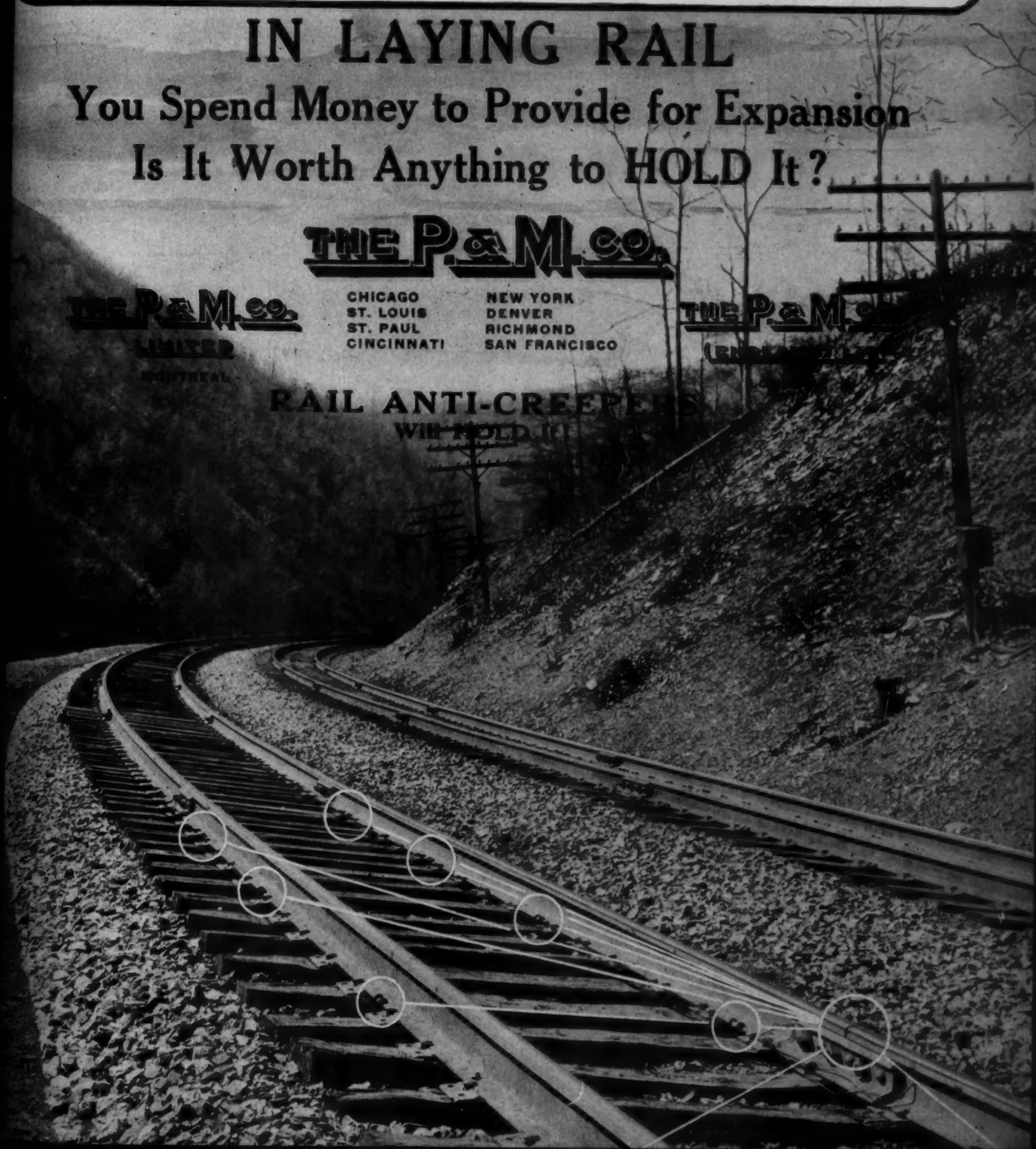
THE P & M CO.
LIMITED
MONTREAL

CHICAGO
ST. LOUIS
ST. PAUL
CINCINNATI

NEW YORK
DENVER
RICHMOND
SAN FRANCISCO

THE P & M CO.
(INCORPORATED)

RAIL ANTI-CREEPERS
WILL HOLD IT



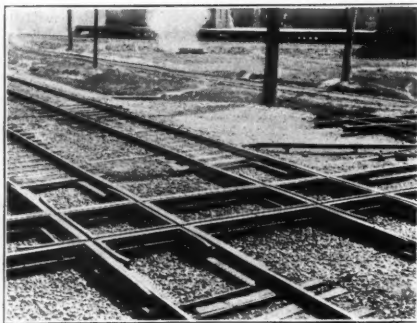
A Plan for Reducing Crossing Maintenance

As practised by Mr. H. M. Steward, Supt. of Maintenance, The Boston Elevated Railway Company. As reported in the March issue of "Electric Traction."

“ON all railroad main-line tracks solid manganese steel crossings, seven inches in depth, are used and are laid on **INTERNATIONAL STEEL CROSSING FOUNDATIONS**, which are laid on from 10 to 12 inches of broken stone tamped with pneumatic tool. A six-inch concrete paving base is installed and the crossings are paved with granite block and grout joints. Anti-rail creepers are installed for a considerable distance on the steam railroad tracks on either side of the crossings to prevent them getting out of line.”

“It is found that if the above type of construction is installed properly the maintenance problem becomes of no moment. Only minor repairs are required during the life of the crossing frogs.”

To assist you in a careful consideration of this method of economizing on crossing maintenance we prepare complete proposal plans showing **INTERNATIONAL STEEL CROSSING FOUNDATIONS** under your crossings.



Steel Crossing Foundations in C.C.C. & St. L. R.R. Main Line since Dec. 1914.

WRITE TODAY!

The International Steel Tie Company

16702 Waterloo Road, Cleveland, Ohio

International Products: Steel Twin Ties; Steel Crossing Foundations; and Steel Paving Guard; are manufactured and sold in Canada by the Sarnia Bridge Company, Ltd., Sarnia, Ont.

International Steel Crossing Foundations

RAILWAY MAINTENANCE ENGINEER

Entered as second-class matter June 23, 1916, at the post office at Chicago, Ill., under the Act of March 3, 1879. Published Monthly by Simmons-Boardman Publishing Company at 608 S. Dearborn St., Chicago. Subscription price, United States, Canada and Mexico, \$3.00 a year; foreign countries, \$5.00 a year.

Alphabetical Index to Advertisements, Page 5

Classified Index of Advertisers, Pages 5 and 6



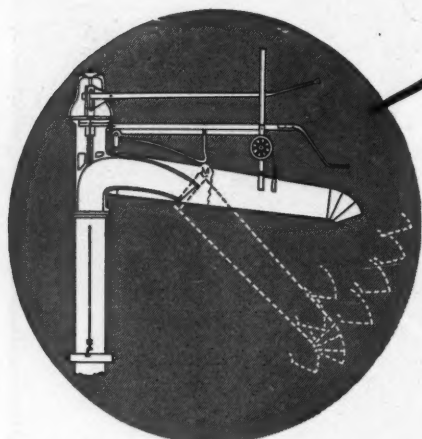
There is no field where performance under all conditions is more emphatically demanded than in the water supply service of the great roads.

"American" Pumps' performance has consistently inspired repeat orders!

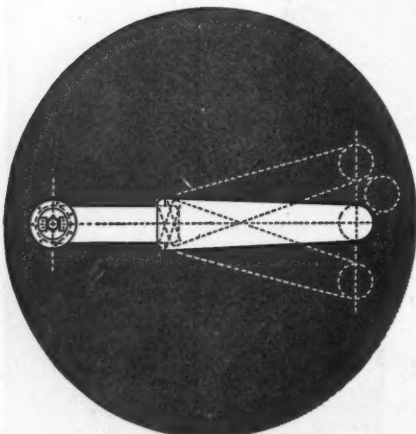
THE AMERICAN WELL WORKS

General Office and Works
AURORA, ILL.

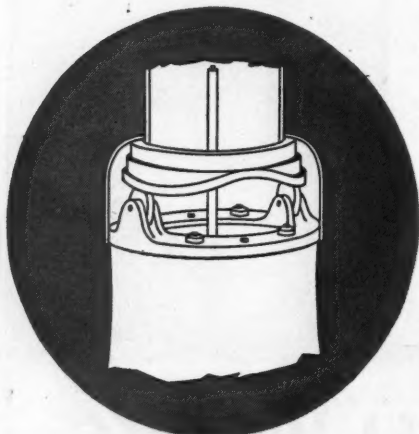
Chicago Office
FIRST NATIONAL BANK BLDG.



SHOWING VERTICAL RANGE
FENNER DROP SPOUT



SHOWING LATERAL RANGE
FENNER DROP SPOUT



GRAVITY TURNING &
LOCKING DEVICE

Its Quicker- Easier-Safer *to fill your tender tanks with* **POAGE Style "H" WATER COLUMN**

Equipped with

Fenner Drop Spout

Quicker and Easier because the spout can be instantly brought into play without accurately spotting the tender. It works equally well with tenders of different heights. The spout has a vertical range of five feet and a lateral range of three.

The spout is non-freezable. Heavy icicles will not gather upon it. There is no packing at the open telescopic joint, yet, it does not leak a drop of water.

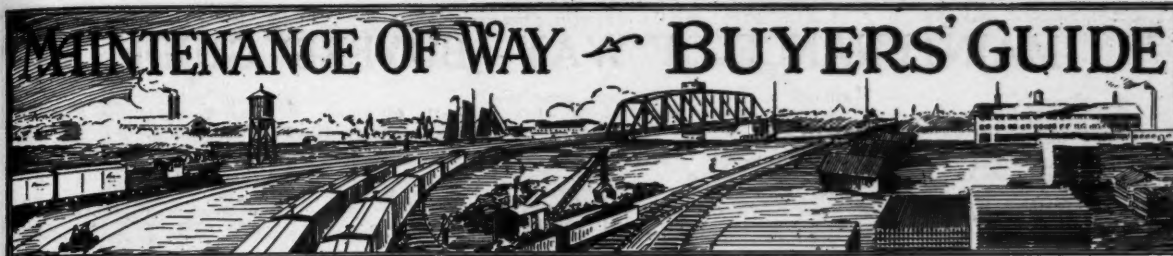
Safer—as soon as it is released the spout swings by gravity to a position parallel with the track and remains there locked. There are no unsafe locking devices to be operated.

The three foot lateral range of the spout prevents the column being tipped over if the tender shifts unexpectedly.

There is no danger of water hammer bursting the mains. The Poage Style H valve shuts off 85 per cent of the flow very quickly and the remaining 15 per cent more slowly—the correct principle to secure quick closure without water hammer.

Try the Poage Style H Water Column—It's better.

MANUFACTURED EXCLUSIVELY BY
**The AMERICAN VALVE
& METER COMPANY**
CINCINNATI, O.



ALPHABETICAL INDEX TO ADVERTISEMENTS

A			F			P		
Air Reduction Co., Inc.	11		Fairbanks, Morse & Co.	27		P. and M. Co., The	1	
American Casting Co.	20		Fairmont Gas Engine and Ry.			Pelton Steel Co.	16	
American Chain Co., Inc.	12		Motor Car Co.	18		Pittsburgh-Des Moines Steel Co.	29	
American Hoist & Derrick Co.	25					Positive Lock Washer Co.	8	
American Saw Mill Machinery Co.	20		G			Q		
American Valve and Meter Co.	4		Gardner Governor Co., The	3		Q and C Co., The	33	
American Well Works	3		Golden-Anderson Valve Specialty Co.	23		R		
Armco Culvert & Flume Mfrs. Assn.	19					Rail Joint Co.	26	
B			H			Ramapo Iron Works	26	
Bethlehem Steel Company	31		Headley Good Roads Co.	32		Rawls Mach. & Mfg. Co.	32	
Bucyrus Co.	31		I			Republic Creosoting Co.	17	
C			Industrial Works	14		Ruberoid Co., The	29	
Chicago Steel Post Co.	7		Ingersoll-Rand Co.	15		S		
Classified Advertisements	28		International Steel Tie Co.	15		St. Louis Frog and Switch Co.	28	
D			L			Stowell Co.	29	
De Vilbiss Mfg. Co., The	25		Lundie Engineering Corp.	32		Sullivan Machinery Co.	25	
Diamond State Fibre Co.	20		M			T		
Dixon Crucible Co., Joseph	28		Massey Concrete Products Corp.	23		Toch Brothers	27	
Du Pont, E. I. De Nemours & Co., Inc.	10		Minwax Co., Inc.	13		V		
			N			Verona Tool Works	34	
			National Lock Washer Co., The	21		W		
			North American Engine Co.	28		Weir Frog Co.	26	
						Wharton & Co., Wm., Jr.	26	
						Wood Shovel and Tool Co., The	9	

CLASSIFIED INDEX OF ADVERTISERS

Acetylene, Dissolved.	Bond Wire.	Cranes, Erecting.	Engines.
Air Reduction Co., Inc.	Armco Culvert & Flume Mfrs. Assn.	Industrial Works	Fairmont Gas Engine & Ry. Motor Car Co.
Adjustable Rail Clamps.	Booster Pumps.	Cots.	Engines, Hand Car.
Wm. Wharton, Jr., & Co.	Gardner Governor Co.	Southern-Rome Co.	Fairbanks, Morse & Co.
Air Compressors.	Horicone Zinc Alloy.	Cranes, Locomotive.	Fairmont Gas Engine & Ry. Motor Car Co.
Fairbanks, Morse & Co.	American Boron Products Co.	Crane, Wrecking.	North American Engine Co.
Gardner Governor Co.	Bracing.	Bucyrus Company.	
Ingersoll-Rand Co.	Air Reduction Co., Inc.	Industrial Works.	
Sullivan Machinery Co.	Buildings.	Creosote Oil.	
Air Hoists.	Des Moines Bridge & Iron Co.	Republic Creosoting Co.	
Ingersoll-Rand Co.	Pittsburgh-Des Moines Steel Co.	Crossings, Highway Bituminous.	
Air-Lift Pumping Systems.	Building Papers.	Headley Good Roads Co.	
Ingersoll-Rand Co.	Ruberoid Co., The.	Crossings.	
Sullivan Machinery Co.	Bunks.	Bethlehem Steel Company.	
Alloy Steel Castings.	Burners, Runsen, Acetylene.	St. Louis Frog & Switch Co.	
Pelton Steel Co.	Air Reduction Co., Inc.	Weir Frog Co.	
Anchors.	Calcium Carbide.	Wm. Wharton, Jr., & Co.	
P. & M. Co., The.	Air Reduction Co., Inc.	Crossing Foundations.	
Anti-Creepers.	Car Jacks.	International Steel Tie Co.	
P. & M. Co., The.	Duff Manufacturing Co.	Culverts.	
Apparatus, Brazing, Welding and Cutting, Heat Treatment.	Cars, Motor, Inspection.	Armco Culvert & Flume Mfrs. Assn.	
Air Reduction Co., Inc.	Fairbanks, Morse & Co.	Culvert Pipe, Cast Iron.	
Argon.	Fairmont Gas Engine & Ry. Motor Car Co.	American Casting Co.	
Air Reduction Co., Inc.	North American Engine Co.	Culvert Pipe, Concrete.	
Asphalt.	Cars, Motor, Section.	Massey Concrete Prod. Corp.	
Ruberoid Co., The.	Fairbanks, Morse & Co.	Curbing.	
Automatic Pump Starters.	Fairmont Gas Engine & Ry. Motor Car Co.	Massey Concrete Prod. Corp.	
Golden-Anderson Valve Specialty Co.	North American Engine Co.	Cutting, Oxy-Acetylene.	
Automatic Valves.	Cars, Velocipede.	Air Reduction Co., Inc.	
Golden-Anderson Valve Specialty Co.	Fairbanks, Morse & Co.	Derrails.	
Barges and Hulls.	Fairmont Gas Engine & Ry. Motor Car Co.	American Chain Co., Inc.	
Des Moines Bridge & Iron Co.	North American Engine Co.	Q. & C. Company.	
Pittsburgh-Des Moines Steel Co.	Castings.	Track Specialties Co.	
Barrels.	American Manganese Steel Co.	Wm. Wharton, Jr., & Co.	
Diamond State Fibre Co.	Bethlehem Steel Company.	Reads Mfg. Co.	
Bars.	Cattle Guards.	Ditchers.	
Bethlehem Steel Company.	Fairbanks, Morse & Co.	American Hoist & Derrick Co.	
Belt Driven Pumps.	Cattle Passes.	Dipper Steel.	
Gardner Governor Co.	Massey Concrete Prod. Corp.	Bucyrus Company.	
Benders, Rail.	Clutch Linings.	Dynamite.	
American Chain Co., Inc.	Diamond State Fibre Co.	E. I. du Pont de Nemours & Co.	
Q. & C. Company.	Coaling Stations.	Dredges.	
Verona Tool Works.	Des Moines Bridge & Iron Co.	Bucyrus Company.	
Billets.	Fairbanks, Morse & Co.	Des Moines Bridge & Iron Co.	
Bethlehem Steel Company.	Pittsburgh-Des Moines Steel Co.	Pittsburgh-Des Moines Steel Co.	
Blasting Powders.	Compromise Joints.	Drop Forgings.	
E. I. du Pont de Nemours & Co.	Bethlehem Steel Company.	Bethlehem Steel Company.	
Blasting Supplies.	Compromise Rail Joints.	Duplex Pumps.	
E. I. du Pont de Nemours & Co.	Track Specialties Co.	Gardner Governor Co.	
Blow Pipes, Oxy-Acetylene.	Conduits.	Engines.	
Air Reduction Co., Inc.	Diamond State Fibre Co.	Fairbanks, Morse & Co.	
Boiler Feed Pumps.	Copper Cleaners.	Electric Light & Power Plants.	
Gardner Governor Co.	American Boron Products Co.	Fairbanks, Morse & Co.	
Bolts.	Corrugated Iron.	Electric Steel Castings.	
Bethlehem Steel Company.	Armco Culvert & Flume Mfrs. Assn.	Stowell Co.	
		Electric Valves.	
		Golden-Anderson Valve Specialty Co.	

MAINTENANCE OF WAY—BUYERS' GUIDE

- Guard Rails.**
Bethlehem Steel Company.
Ramapo Iron Works.
Wm. Wharton, Jr., & Co.
- Guard Rail Clamps.**
American Chain Co., Inc.
Q. & C. Company.
Ramapo Iron Works.
Track Specialties Co.
Weir Frog Co.
- Hand Cars.**
Fairbanks, Morse & Co.
- Hand Car Engines.**
Fairmont Gas Engine & Ry.
Motor Car Co.
North American Engine Co.
- Hammer Drills.**
Sullivan Machinery Co.
- Headlights, Motor Car.**
Carbic Mfg. Co.
- High Tee Rail.**
Bethlehem Steel Company.
- Hoists.**
Fairbanks, Morse & Co.
Lidgerwood Mfg. Co.
- Hydrogen.**
Air Reduction Co., Inc.
- Insulated Rail Joints.**
Rail Joint Co.
- Track Specialties Co.**
- Junction Boxes.**
Massey Concrete Prod. Corp.
- Jacks.**
Duff Manufacturing Co.
Fairbanks, Morse & Co.
Verona Tool Works.
- Lanterns, Motor Car.**
Carbic Mfg. Co.
- Locomotive Cranes.**
Industrial Works.
- Locomotive Jacks.**
Duff Manufacturing Co.
- Lubricants.**
Jos. Dixon Crucible Co.
- Machinery.**
Bethlehem Steel Company.
- Machinery, Gas Producers.**
Air Reduction Co., Inc.
- Malleable Castings.**
Stowell Co.
- Manganese Steel Castings.**
Pelton Steel Co.
- Manganese Track Work.**
Bethlehem Steel Company.
Ramapo Iron Works.
Wm. Wharton, Jr., & Co.
- Manholes.**
Massey Concrete Prod. Corp.
- Markers.**
Massey Concrete Prod. Corp.
- Membranous Waterproofing.**
Minwax Co., Inc.
- Metal Cleaners.**
American Boron Products Co.
- Mill Posts.**
Massey Concrete Prod. Corp.
- Motor Car Lanterns.**
Carbic Mfg. Co.
- Motor Cars.**
Fairbanks, Morse & Co.
Fairmont Gas Engine & Ry.
Motor Car Co.
- Mowers, Track.**
Rawls Machine & Mfg. Co.
- Nitrogen.**
Air Reduction Co., Inc.
- Nut Locks.**
National Lock Washer Co.
Positive Lock Washer Co.
- Nuts.**
Bethlehem Steel Company.
- Oil Engines.**
Bethlehem Steel Company.
Fairbanks, Morse & Co.
Ingersoll-Rand Co.
- Oil Houses.**
Massey Concrete Prod. Corp.
- Oil Pumps.**
Gardner Governor Co.
- Ordinance.**
Bethlehem Steel Company.
- Out Houses.**
Massey Concrete Prod. Corp.
- Outfit, Welding.**
Air Reduction Co., Inc.
- Oxygen.**
Air Reduction Co., Inc.
- Paints.**
Jos. Dixon Crucible Co.
Ruberoid Co., The.
Toch Brothers.
- Paint Spraying Equipment.**
De Vilbiss Mfg. Co., The.
- Pencils.**
Jos. Dixon Crucible Co.
- Penstocks.**
American Valve & Meter Co.
- Pig Iron.**
Bethlehem Steel Company.
- Pile Drivers.**
Bucyrus Company.
Industrial Works.
- Piling.**
Massey Concrete Prod. Corp.
- Pinions.**
Diamond State Fibre Co.
- Pipe, Cast Iron.**
American Casting Co.
- Pipe, Concrete.**
Massey Concrete Prod. Corp.
- Pipe Carriers.**
Massey Concrete Prod. Corp.
- Pipe Joint Compound.**
Jos. Dixon Crucible Co.
Ruberoid Co., The.
- Pipe, Riveted Steel.**
Des Moines Bridge & Iron Co.
Pittsburgh-Des Moines Steel Co.
- Plants, Welding and Cutting.**
Air Reduction Co., Inc.
- Plunger Pumps.**
Gardner Governor Co.
- Pneumatic Tie Tamperers.**
Ingersoll-Rand Co.
- Poles, Concrete.**
Massey Concrete Prod. Corp.
- Powders.**
E. I. du Pont de Nemours & Co.
- Power Houses.**
Massey Concrete Prod. Corp.
- Power Pumps.**
Gardner Governor Co.
- Producers, Gas.**
Air Reduction Co., Inc.
- Pumps.**
American Well Works.
Fairbanks, Morse & Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.
- Pump Governors.**
Gardner Governor Co.
- Push Cars.**
Fairbanks, Morse & Co.
- Rail Anchors.**
P. & M. Co., The.
- Rail Anti-Creepers.**
P. & M. Co., The.
- Rail Benders.**
Fairbanks, Morse & Co.
Q. & C. Company.
Track Specialties Co.
- Rail Braces.**
Bethlehem Steel Company.
Q. & C. Company.
- Rail Joints.**
American Chain Co., Inc.
Q. & C. Company.
Rail Joint Co.
Wm. Wharton, Jr., & Co.
- Rail Saws.**
Fairbanks, Morse & Co.
Industrial Works.
Q. & C. Company.
- Rare Gases.**
Air Reduction Co., Inc.
- Receiver Pumps.**
Gardner Governor Co.
- Regulators, Oxy-Acetylene.**
Air Reduction Co., Inc.
- Replacers, Car.**
American Chain Co., Inc.
Q. & C. Company.
- Riveting Hammers.**
Ingersoll-Rand Co.
Verona Tool Works.
- Rivets.**
Bethlehem Steel Company.
- Rock Drills.**
Ingersoll-Rand Co.
Sullivan Machinery Co.
Verona Tool Works.
- Rods, Welding.**
Air Reduction Co., Inc.
- Roof Slabs.**
Fairbanks, Morse & Co.
Massey Concrete Prod. Corp.
- Roofing and Siding.**
Fairbanks, Morse & Co.
- Rules, Boxwood.**
Lufkin Rule Co., The.
- Rules, Spring Joint.**
Lufkin Rule Co., The.
- Rules, Steel.**
Lufkin Rule Co., The.
- Saw Mills.**
American Saw Mill Machinery Co.
- Scales, Mechanics'.**
Lufkin Rule Co., The.
- Screw Spike Drivers.**
Ingersoll-Rand Co.
- Sewer Pipe.**
American Casting Co.
Massey Concrete Prod. Corp.
- Sewer Pine Seal Compound.**
Ruberoid Co., The.
- Sheets, Fibre.**
Diamond State Fibre Co.
- Sheet Iron.**
Armco Culvert & Flume Mfrs. Assn.
- Shovels.**
Wood Shovel and Tool Co., The.
- Signal Foundations, Concrete.**
Massey Concrete Prod. Corp.
- Skid Shoes.**
Q. & C. Company.
- Slabs, Concrete.**
Massey Concrete Prod. Corp.
- Smoke Stacks.**
Des Moines Bridge & Iron Co.
Massey Concrete Prod. Corp.
Pittsburgh-Des Moines Steel Co.
- Snow Melting Devices.**
Q. & C. Company.
- Snow Plows.**
Q. & C. Company.
- Special Analysis Steel Castings.**
Pelton Steel Co.
- Spikes.**
Bethlehem Steel Company.
- Spraying Equipment, Paint.**
De Vilbiss Mfg. Co., The.
- Spreader Plow.**
Bucyrus Company.
- Standard Tee Rails.**
Bethlehem Steel Company.
- Standpipes.**
American Valve & Meter Co.
Des Moines Bridge & Iron Co.
Fairbanks, Morse & Co.
Pittsburgh-Des Moines Steel Co.
- Station Houses.**
Massey Concrete Prod. Corp.
- Steam Engine Governors.**
Gardner Governor Co.
- Steam Pumps.**
Gardner Governor Co.
- Steam Shovels.**
American Hoist & Derrick Co.
Bucyrus Company.
- Steel Castings.**
Pelton Steel Co.
- Steel Plates and Shapes.**
Bethlehem Steel Company.
Des Moines Bridge & Iron Co.
Pittsburgh-Des Moines Steel Co.
- Steel Posts.**
Chicago Steel Post Co.
- Steel Shovels.**
Wood Shovel and Tool Co., The.
- Steel Ties.**
International Steel Tie Co.
- Step Joints.**
American Chain Co., Inc.
Q. & C. Company.
Rail Joint Co.
- Storage Tanks.**
Des Moines Bridge & Iron Co.
Pittsburgh-Des Moines Steel Co.
- Street Railway Special Work.**
Bethlehem Steel Company.
- Structural Steel.**
Bethlehem Steel Company.
- Switches.**
Bethlehem Steel Company.
Ramapo Iron Works.
- St. Louis Frog & Switch Co.**
Track Specialties Co.
Weir Frog Co.
Wm. Wharton, Jr., & Co.
- Switch Locks.**
American Valve & Meter Co.
- Switchmen's Houses.**
Massey Concrete Prod. Corp.
- Switch Stands.**
Wm. Wharton, Jr., & Co.
- Switchstands and Fixtures.**
American Valve & Meter Co.
Bethlehem Steel Company.
Fairbanks, Morse & Co.
Ramapo Iron Works.
Weir Frog Co.
- Tampers.**
Ingersoll-Rand Co.
- Tanks.**
Des Moines Bridge & Iron Co.
Fairbanks, Morse & Co.
Pittsburgh-Des Moines Steel Co.
- Tank Valves.**
American Valve & Meter Co.
- Tapes, Measuring, All Kinds.**
Lufkin Rule Co., The.
- Telegraph Poles.**
Massey Concrete Prod. Corp.
- Telephone Booths.**
Massey Concrete Prod. Corp.
- Throttling Governors.**
Gardner Governor Co.
- Tie Plates.**
Bethlehem Steel Company.
Lundie Engineering Corp.
Track Specialties Co.
- Tie Plate Clamps.**
Q. & C. Company.
- Tie Rods.**
Bethlehem Steel Company.
- Tie Spacers.**
American Chain Co., Inc.
- Tin Plate.**
Bethlehem Steel Company.
- Tongue Switches.**
Bethlehem Steel Company.
- Tool Steel.**
Bethlehem Steel Company.
- Tools, Oxy-Acetylene Welding and Cutting.**
Air Reduction Co., Inc.
- Torches, Blow Acetylene.**
Air Reduction Co., Inc.
- Torches, Blow Combination.**
Air Reduction Co., Inc.
- Torches, Welding Acetylene.**
Air Reduction Co., Inc.
- Torches, Welding and Cutting.**
Air Reduction Co., Inc.
- Track Drills.**
Fairbanks, Morse & Co.
- Track Insulation.**
Diamond State Fibre Co.
- Track Jacks.**
Duff Manufacturing Co.
Verona Tool Works.
- Track Material.**
Ramapo Iron Works.
Weir Frog Co.
- Track Mowers.**
Rawls Machine & Mfg. Co.
- Track Pans.**
Des Moines Bridge & Iron Co.
Pittsburgh-Des Moines Steel Co.
- Track Scales.**
Fairbanks, Morse & Co.
- Track Tools.**
Fairbanks, Morse & Co.
Q. & C. Company.
Verona Tool Works.
- Trestle Slabs.**
Massey Concrete Prod. Corp.
- Vacuum Pumps.**
Gardner Governor Co.
- Valves.**
Golden-Anderson Valve Specialty Co.
- Varnish, Electrical Insulating.**
Ruberoid Co., The.
- Washers.**
Diamond State Fibre Co.
- Water Column.**
American Valve & Meter Co.
- Water Crane.**
American Valve & Meter Co.
- Waterproofing.**
Minwax Co., Inc.
Ruberoid Co., The.
- Water Regulating Valves.**
Golden-Anderson Valve Specialty Co.
- Water Tanks.**
Des Moines Bridge & Iron Co.
Pittsburgh-Des Moines Steel Co.
- Water Works Pumps.**
Gardner Governor Co.
- Weed Killer.**
Reade Mfg. Co.
- Welding, Oxy-Acetylene.**
Air Reduction Co., Inc.
Carbic Mfg. Co.
- Wheels (Hand and Motor Car).**
Fairmont Gas Engine & Ry.
Motor Car Co.
- Wire.**
Armco Culvert & Flume Mfrs. Assn.
- Wire Rope.**
Fairbanks, Morse & Co.
- Wood Preserving Oil.**
Republic Creosoting Co.
- Wood Working Machinery.**
American Saw Mill Machinery Co.
- Wrecking Cranes.**
Bucyrus Company.
Industrial Works.



The RED TOP Guarantee

WE guarantee RED TOP Steel Posts will not break, burn, rot or frost-heave in the fence line; that they are free from defects in material and workmanship; that they will outlast the heaviest fencing manufactured.

We guarantee RED TOP Posts to be just as represented in our literature and advertising.

Any RED TOP Post which does not fulfill the above guarantee will be replaced by your dealer—without cost or argument.

BROOKE ANDERSON, *Pres.*

CHICAGO STEEL POST CO.

Railway Representatives

Maintenance Equipment Co.

Railway Exchange Bldg., Chicago, Ill.

For booklet describing RED TOP Guaranteed Steel Fence Posts and their money saving features, address **Maintenance Equipment Co., Railway Exchange Bldg., Chicago, Ill.**

Red Top

GUARANTEED

Steel Fence Posts

CERTAIN CORRECT and POSITIVE

absolutely dependable the "Positive" affords that safety and economy which present conditions demand.

Study the illustrations to the right and you will quickly grasp the positive points of the Genuine Positive—"the never loosening medium." Look at the barbs, note how they grip the nut—the upper barb imbedded in the nut, the lower one in the face of the plate. Exactly! It is those barbs and their ratchet-like action that afford your guarantee against loosened fish plates, and make this washer

POSITIVE
in Name
in Safety
and in
Economy

Made of Keystone shape steel—the best procurable—which affords rectangular cross-section and full bearing efficiency, the "Positive" is scientifically planned to insure maximum holding power and minimum track maintenance cost.

Remember you can't go wrong with the "Positive"—*either side up is correct.*

Specify Positive on your next requisition and you'll be sure of Positive safety and economy.

THE POSITIVE LOCK WASHER CO.

Manufacturers also of Plain Type Lock Washers

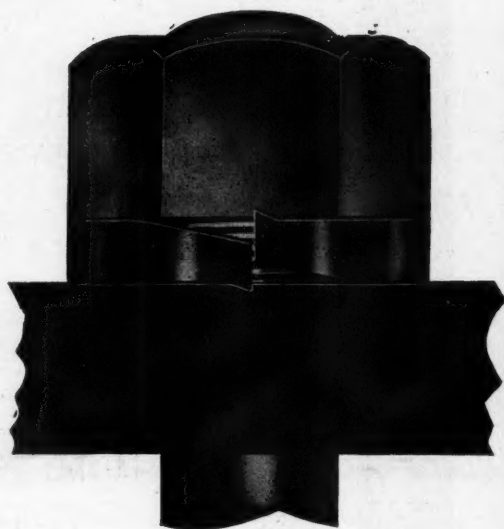
Main Office and Factory NEWARK, N. J.

Foreign Office:

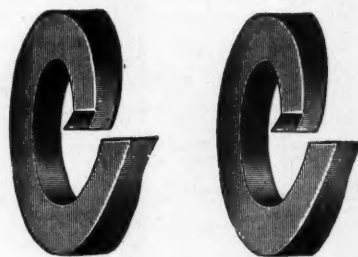
THE POSITIVE LOCK WASHER COMPANY
80-84 James Watt Street
Glasgow, Scotland

Pacific Coast Office:

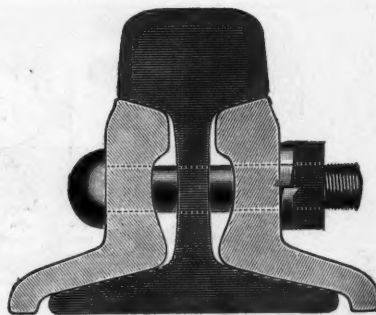
H. L. VAN WINKLE COMPANY
160 Beale Street
San Francisco, California



LOCK



WASHER





Here's a shovel that outlasts all others

HERE'S a shovel that lives longer than any shovel you ever had. It is made of Mo-lyb-den-um Steel—the *hardest* and *toughest* steel known—and also the *lightest*.

Because it is so hard, it gives you a shovel that wears with imperceptible slowness.

Because it is so tough, a shovel is produced that will not nick, crack or break, no matter how it is used.

Because it is so light, a lighter shovel can be made. And with *longer-lived* and *lighter* shovels, you will have *reduced* shovel

costs and increased production.

The straps of Wood's Mo-lyb-den-um Shovels will not come loose from the blade. They are welded perfectly. The handles are made of seasoned second-growth Northern Ash.

Everything about Wood's Mo-lyb-den-um Shovels has been built up to the Wood standards which have made the line famous for perfect workmanship and quality finish.

Write for a special folder which will show you that Wood's Mo-lyb-den-um Shovel is ideal for track maintenance.

THE WOOD SHOVEL AND TOOL COMPANY
Piqua, Ohio

U. S. A.



Wood's Mo-lyb-den-um Shovels

The American Super Steel



NOTABLE IMPROVEMENTS

in the Transportation and Storage of
Explosives That SAVE LIVES and Dollars

Branch Offices:

Birmingham, Ala.
Boston, Mass.
Buffalo, N. Y.
Chicago, Ill.
Denver, Colo.
Duluth, Minn.
Huntington, W. Va.
Joplin, Mo.
Juneau, Alaska
Kansas City, Mo.
New York, N. Y.
Pittsburgh, Pa.
Portland, Ore.
St. Louis, Mo.
San Francisco, Calif.
Scranton, Pa.
Seattle, Wash.
Spokane, Wash.
Springfield, Ill.

Du Pont Products Exhibit
Atlantic City, N. J.

IT is the constant aim of this Company not only to improve the efficiency of explosives, but to safeguard their transportation and storage so as to minimize all hazards.

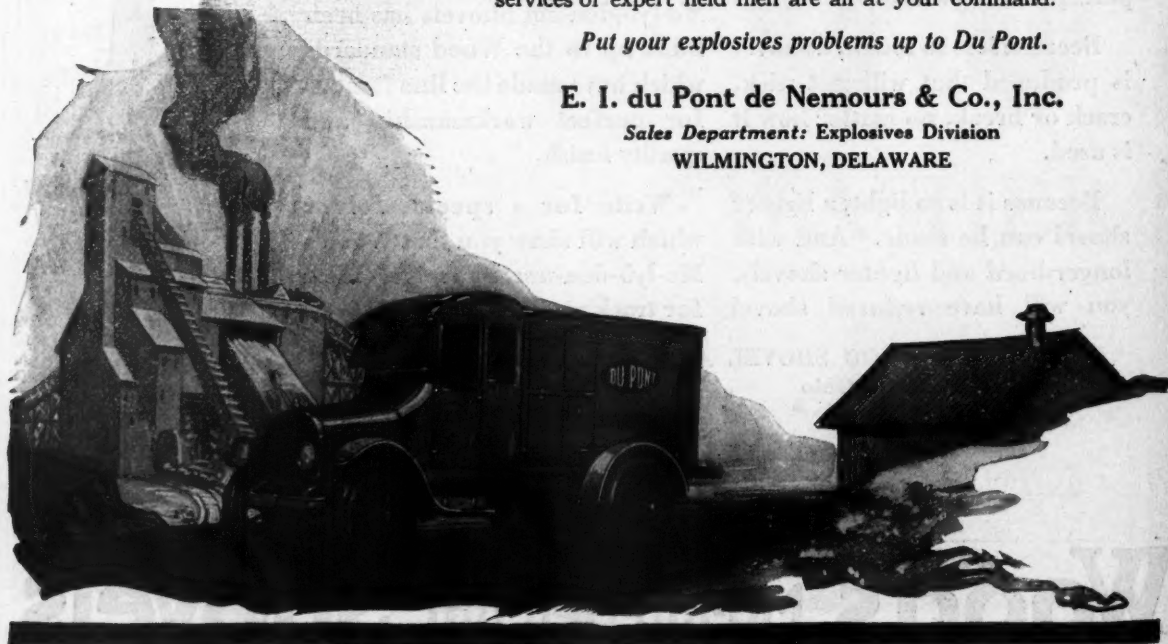
That our work along these lines has been successful is evidenced by the fact that during the year 1919 the Bureau for the Safe Transportation of Explosives and other Dangerous Articles reported that there was no loss of life nor property resulting from the lawful transportation of commercial explosives in the United States.

Du Pont Explosives Service covers every possible phase of the important business of developing, making, distributing and using explosives. The great Du Pont laboratories and plants with their highly trained staffs of chemists and technicians, a widespread, efficient distributing system and the practical services of expert field men are all at your command.

Put your explosives problems up to Du Pont.

E. I. du Pont de Nemours & Co., Inc.

Sales Department: Explosives Division
WILMINGTON, DELAWARE



AIRCO OXYGEN AND ACETYLENE SERVICE

IS GOOD SERVICE

Good Oxygen and Acetylene Service

prevents loss of time and misunderstandings,
and insures the operator being free to think
about nothing but the success of his work.
Airco has the distributing stations to provide
good oxygen and acetylene service.

Air Reduction Sales Company

*Manufacturers of Airco Oxygen, Airco Acetylene,
Airco Welding and Cutting Apparatus
and Other Airco Products*

Home Office:
342 MADISON AVE.,
NEW YORK, N. Y.

Airco Plants and District Offices:

*Atlanta	*Detroit	*New York
*Bethlehem, Pa.	*Emeryville, Cal.	*Okla. City
*Boston	*Gloucester, N. J.	*Philadelphia
*Buffalo	*Jersey City, N. J.	*Pittsburgh
*Chicago	*Johnstown, Pa.	*Richmond
*Cleveland	*Madison, Ill.	*Seattle
*Costesville, Pa.	*Minneapolis	*St. Louis
*Defiance, O.		*Warren, O.

Airco warehouses at intermediate points

*Denotes city contains both Airco Plant and
District Office. Other cities contain only
plants. Address nearest District Office.

Airco Products: Oxygen, Acetylene, Welding
and Cutting Apparatus and Supplies, Acetylene
Generators, Carbide, Nitrogen, Argon.

Airco being used
to weld a worn
frog. Thousands
of dollars can be
saved by reclaim-
ing frogs in this
manner.

Send for the Airco Frog Welding Booklet entitled, "An Airco Achievement." Mention Maintenance of Way Engineer when writing.



The Trackman's Tool Box!

Have you equipped him to keep the tracks shipshape, sound and efficient? Reading Rail Benders and Reading Tie Spacers illustrated here are two track accessories which should be on the equipment list of every maintenance of way department.

READING RAIL BENDERS

The correct mechanical principle worked out in Reading Rail Benders enables them to bend any given size of rail with half the effort required by other rail bending devices. Frames are made of high quality heat treated cast steel; screws of cold rolled steel, and bushings of a special bronze.

READING TIE SPACER

With a Reading Tie Spacer your trackman can keep the tracks shipshape. Ties out of place mean low joints, bent rails, bad switches—danger. Made in three sizes to suit all weights of rails.

American Chain Co., Inc.
Reading Specialties Division

Bridgeport,



Connecticut

In Canada: Dominion Chain Co., Ltd., Niagara Falls, Ont.

GENERAL SALES OFFICE:

GRAND CENTRAL TERMINAL, NEW YORK CITY

DISTRICT SALES OFFICE:

Boston Chicago Philadelphia Pittsburgh San Francisco Portland, Ore.

Other Reading Specialties

*Car and Engine Re-
placers*

*Compromise or Step
Joints*

Guard Rail Clamps

Portable Safety Derrail

Car Chocks

MINWAX

MINWAX

MINWAX

MINWAX

MINWAX

MINWAX

TRADE

MINWAX

MARK

The Original Elastic Membrane Waterproofing System MINIMIZES MAINTENANCE

The expansion joints—usually a weak spot in any waterproofing course—are as dependable as the rest of the protection, where the Minwax System is used. Minwax Expansion Joint Cement is *permanently* elastic, *permanently* pliable, bonds *permanently* to any material, makes a *permanently* impervious joint. These qualities—in combination with the *permanent* elasticity and pliability of the Minwax Waterproof blanket—give *permanent* water protection to any structure waterproofed by the Minwax System. Service records prove.

Let us send Bulletin 11

MINWAX COMPANY, Inc.

Manufacturers and Consulting Engineers on Waterproofing Problems

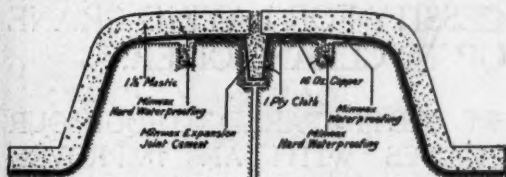
18 East 41st Street, New York

Chicago

Philadelphia

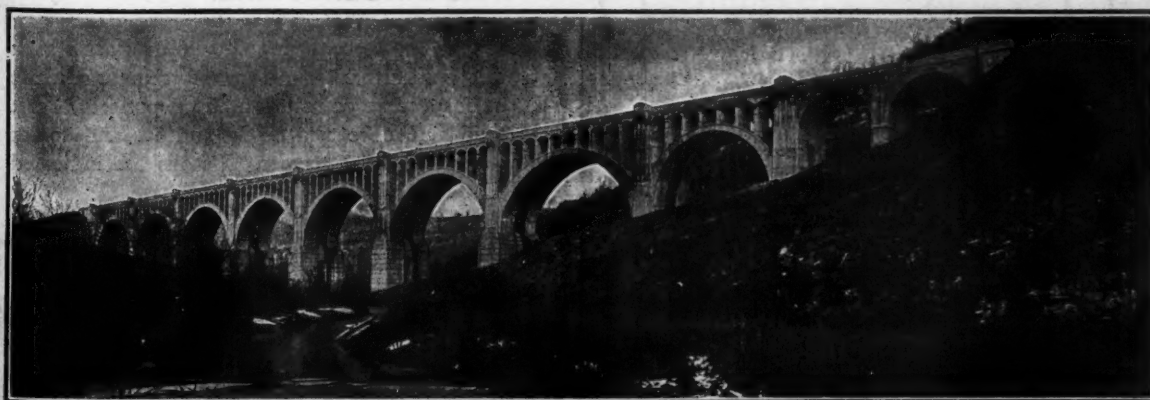
327 So. La Salle Street

509 Harrison Building



Detail of Bridge Floor Expansion Joint,
Minwax Sub-level System

"The Proof of Quality is a Record of Service"



Martin's Creek Viaduct, D. L. & W. R. R.; Waterproofed by the Minwax Elastic Membrane System

MINWAX

MINWAX

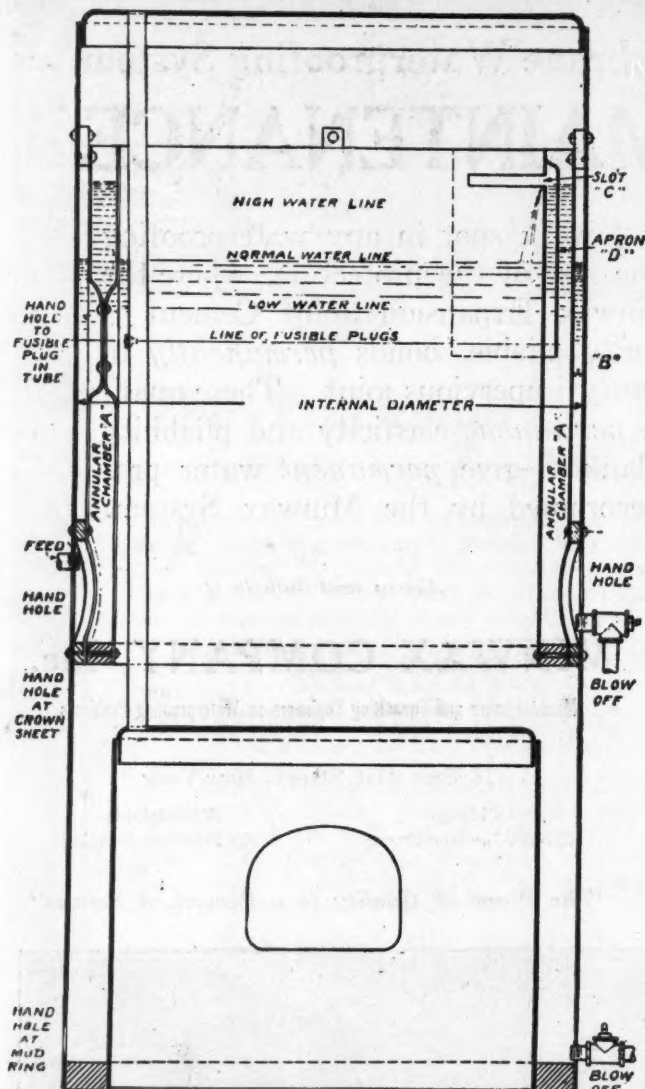
MINWAX

MINWAX

MINWAX

MINWAX

INDUSTRIAL CRANES



SECTIONAL VIEW
OF
SCALE PROOF BOILER

Patented May 13, 1919,
by T. T. Parker.

SELF-CLEANING SCALE-PROOF BOILER

NOW AVAILABLE FOR USE ON

"Industrial" Cranes

THIS GREAT IMPROVEMENT IN BOILER CONSTRUCTION GIVES GREATER EFFICIENCY OF BOILER AND CRANE OPERATION, ALSO LONGER LIFE OF BOILER. OBVIATES NECESSITY FOR LAYING CRANE UP TO CLEAN BOILER.

WE ARE PREPARED TO EQUIP OUR CRANES WITH AN IMPROVED TYPE OF BOILER HAVING A FEED WATER PURIFIER BUILT WITHIN THE BOILER SHELL.

All feed water entering the boiler passes thru this purifier. Dirt and scale forming impurities in suspension or solution are deposited as soft mud at the bottom of the purifier and do not enter the boiler proper. Details are indicated in the cut.



INDUSTRIAL WORKS
BAY CITY, MICHIGAN.



NEW YORK
50 Church Street

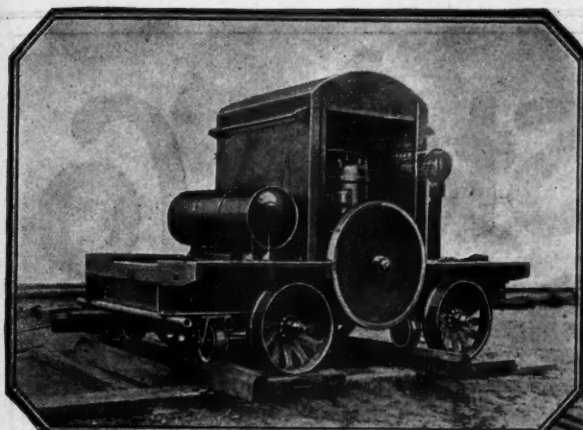
PHILADELPHIA
Widener Bldg.

DETROIT
Book Building

CHICAGO
McCormick Bldg.

C. B. Davis Engineering Co., Birmingham, Ala.; J. G. Miller, St. Louis, Mo.;
F. H. Hopkins & Co., Montreal, Que.; N. B. Livermore & Co., San Francisco, Cal.;
Northwestern Equipment Co., Portland, Ore., and Seattle, Wash.

Locomotive, Erection and Wrecking Cranes, 5 to 160 tons capacity. Pile Drivers, Pillar Cranes, Transfer Cranes, Rail Saws
Prompt deliveries can be made on any type of crane.



"Little David" Air Tools Save Labor on Maintenance Work

For instance, the No. 9 Rail Drill puts a $\frac{7}{8}$ " hole through the web of the rail in 25 seconds. Any quick clamping "old man," either over the rail (as shown) or under, may be used for the feed.



No. 9 Rail Drill

The portable No. 7 Grinder is used for quickly grinding switch points, rail joints and for other similar work along the line. This handy, rugged machine proves a real economy in operation.



No. 7 Portable Grinder

"Little David" Air Tools, because of the saving they afford, have been adopted by many railroads as part of the Maintenance of Way Department's Standard Repair Kit.

Send for Catalog 8000 describing this complete line of air tools.

The portable "Imperial" Tie Tamper Compressor is a handy machine for operating these tools.

INGERSOLL-RAND COMPANY

General Offices:

11 Broadway, New York

Offices Everywhere

157-TT

Ingersoll-Rand

"Imperial" Pneumatic Tie Tampers

Pelton Steel Co.

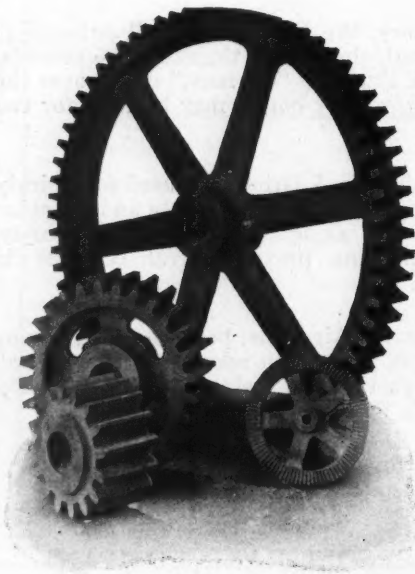
MILWAUKEE, WISCONSIN

Manufacturers of

Open Hearth and Electric Castings

of

Plain Carbon Alloy or
Manganese Steel



Steel castings for certain uses require special strengths or characteristics to meet the requirements of the parts, members, machines or service.

The requirements to be met may be specified either in terms of chemical analysis or of physical characteristics.

If the latter, it is then the duty of the foundryman to deliver steel of such analysis as will meet the physical specifications.

This company is in position to fill orders for high grade castings of such chemical analysis as will meet any reasonable physical requirement.

PELTON STEEL CO.

Knows how to make them
Makes them every day
Is organized for quality production
Gives exceptional service for ordinary prices.



Ties treated with this oil Last Longer

Every purchasing agent recognizes the value of tie and timber treatment with a preservative—but how many of you know the *permanent properties* of the oil you buy?

Reilly's Improved Permanent Creosote Oil has *three times the permanent properties* of the next best competing oil. Has a higher boiling point—enters the wood fibre easily—and *stays in!* Contains no adulterant of any character.

Won't evaporate under a broiling sun—won't dissolve when in contact with rain and slush, gives positive, permanent protection. Ties so treated last much longer.

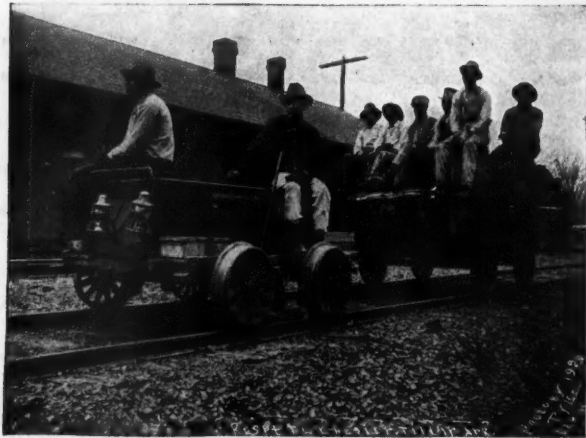
Track maintainance costs are reduced, and your own good judgment is respected. Specify Reilly's in awarding tie contracts, and use it in your own treating plant.

REPUBLIC CREOSOTING COMPANY

Indianapolis, Indiana

Plants: Indianapolis Minneapolis Mobile Seattle Norfolk

performance on **the job COUNTS**



**Over 23,000
Fairmont Motors
in Operation--**

Check up the Fairmont Motors and motor cars on your road—compare their work, their operating cost and the length of time they have been on the job with that of any other section car motor or motor car.

Fairmont Motors are increasing the efficiency and decreasing the up-keep cost on maintenance work on nearly every railroad system in America.

Twelve years' success—over 23,000 Fairmont Motors in operation. These facts, backed by performance on the job, have placed the name Fairmont first among railway motors and motor cars.

We have some maintenance records which will be of value to you. Write us for your copy.

Fairmont Gas Engine & Railway Motor Car Co.
Dept. C-7, FAIRMONT, MINN.

Why-

Fairmont

**Ball Bearing
Motors**

Railway Maintenance Engineer

Vol. 17

July, 1921

Number

(With which is incorporated the Engineering and Maintenance of Way Edition of the *Railway Age* and *Railway Engineering and Maintenance of Way*.)

Published on the last Thursday preceding the date of issue by the
SIMMONS-BOARDMAN PUBLISHING CO.,
TRANSPORTATION BUILDING, CHICAGO, ILL.
NEW YORK: WOOLWORTH BLDG. CLEVELAND: 4300 EUCLID AVENUE
WASHINGTON: HOME LIFE BLDG. CINCINNATI: 1ST NATIONAL BANK BLDG.
PHILADELPHIA: 407 BULLETIN BLDG.
LONDON: 34 VICTORIA ST., WESTMINSTER, S. W. 1.
CABLE ADDRESS—URASIGMEC.

EDWARD A. SIMMONS, President.
LUCIUS B. SHERMAN, Vice-President. SAMUEL O. DUNN, Vice-President.
HENRY LEE, Vice-President and Treas. C. R. MILLS, Vice-President.
ROY V. WRIGHT, Secretary.

ELMER T. HOWSON, Editor.
WALTER S. LACHER, Managing Editor. DAVID A. STEEL, Associate Editor.
MILBURN MOORE, Associate Editor. H. F. LANE (Washington, D. C.).
ROBERT E. THAYER (London, Eng.)

Entered at the postoffice at Chicago, Ill., as mail matter of the second class.

Subscription price, \$3.00; foreign countries, \$5.00 1£-5s. Single copies, 35 cents. Foreign subscriptions may be paid through our London office (34 Victoria Street, S. W. 1) in £-s-d.

WE GUARANTEE, that of this issue 6,700 copies were printed; that of these 6,700 copies, 6,162 were mailed to regular paid subscribers, 76 were mailed to advertisers, 35 were mailed to employees and correspondents, and 427 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were \$1,500, an average of 7,357 copies a month.

The *Railway Maintenance Engineer* is a member of the Associated Business Papers (A. B. P.) and of the Audit Bureau of Circulation (A. B. C.).

22

CONTENTS

EDITORIALS	235
LETTERS TO THE EDITOR.....	237
RAILROADS FIGHT COLORADO FLOODS.....	239
EXPENDITURES FOR NEW FACILITIES LOOM LARGER	244
HOW CAN WE SECURE GREATER EFFICIENCY?.....	245
THE REPAIR OF SWITCH STANDS AND LAMPS: B. J. SCHWENDT	251
WELL INSPECTION, TESTING AND WATER EXAMINATION: FRED D. YEATON	254
HOW TO SUPERELEVATE TRACKS ON BRIDGES	
AVOID EXCESSIVE DAPPING OF THE TIES: R. H. REID.....	255
EACH METHOD HAS ITS PLACE: F. E. SCHALL.....	256
RULES FOR SUPERELEVATING TIES: G. W. ANDREWS.....	257
THE USE OF THE BALLAST DECK SIMPLIFIES THE SUPER-ELEVATION PROBLEM: A. F. ROBINSON.....	257
RAILWAY EMPLOYEES RECLASSIFIED	258
LABOR BOARD CLEARS UP POINTS OF CONTROVERSY	259
REMARKABLE RESULTS FROM TIE TREATING	260
SECTION FOREMAN HELD RESPONSIBLE FOR BAD WRECK.....	260
RAILWAY AFFAIRS AT THE NATION'S CAPITAL.....	261
NEW DEVICES	263
WHAT'S THE ANSWER?	265
ASSOCIATION ACTIVITIES	267
THE MATERIAL MARKET	267
GENERAL NEWS	268

Elsewhere in this issue we publish a series of contributions by officers responsible for the maintenance of bridges

An Advantage of Ballasted Floors

who outline and discuss the various methods used by the railroads in obtaining the super-elevation of tracks on bridges, particularly wooden trestles. There is nothing essentially new about any of the methods advanced in these articles, except perhaps as modern railroad practice has demonstrated that some of them are more applicable to present conditions than others. One thought, however, has been brought out emphatically which has a direct bearing on the present tendencies in railway bridge floors, namely, that there is a marked advantage in the use of the ballasted floors wherever it is necessary to super-elevate the track. Not only does this do away with a great deal of expense and trouble in the detailing and construction of the timber work for the bridge deck, but it leaves the track in a condition which makes it very easy to change the amount of super-elevation whenever conditions indicate that this is desirable.

Present indications point to the opening up of maintenance work on a large scale on a number of roads now,

It Is Time to Get Busy

under the impetus of the reduction in wages, and it is to be hoped that this action will become universal. The roads are now well advanced in their fifth season of restricted maintenance and the properties are showing the effects. At no time in recent years has the amount of work pressing

for attention been as large as now. At the same time the season is now so far advanced that work must be started at once if any marked progress is to be made this year, and another year of comparative inaction is not added to those which have already preceded. Just as success comes to the railway management that interprets the future accurately and prepares in advance for expected traffic, so will best results come to that maintenance officer, whether he be chief engineer, supervisor or foreman, who now prepares to take advantage of the first increase in allowances of men and materials to get the property under his direction into the best possible condition before winter.

Any period of wage reductions is one of dissatisfaction among employees. It is, however, a necessary corollary

Wage Reductions and the Cost of Living

to wage increases. Employees in the maintenance of way department enjoyed several increases during the last four years. They are now experiencing the first reduction. We hear much about the "return to normalcy"; yet it can come only as each industry joins in the movement to reduce costs of production and each employee contributes his share by accepting reductions in wages. There are few products in which labor does not comprise the largest element of cost, either directly or indirectly. The cost of these products can therefore fall only as the cost of the labor entering into them decreases. The value of any wage is measured by what it will purchase. A reduction in wages which keeps pace with falling costs of living

therefore leaves an employee no worse off than before. Government statistics show that the cost of living is falling. It will fall still more as the reductions in wages become universal. A period of readjustment such as we are now passing through is unpleasant, but it is a necessary step in the return to the period of normal wages and normal costs of living when old relationships will be re-established.

Any one connected with the maintenance of way department who has ever had occasion to study the statistics of

A New Classification of Employees

the Interstate Commerce Commission with respect to employees, their number and compensation, has been struck by the fact that the classification of maintenance of way employees as recorded in the annual reports of the commission was entirely inadequate, confusing and therefore of little value. All foremen other than section foremen were grouped in one class. Carpenters were all reported under one head, whether employed on bridges, buildings, cars or locomotives. All supervisory forces were classed as division officers and all engineers or engineering assistants, other than division and general officers, in both the maintenance of way and mechanical departments, were placed under one general head as assistant engineers and draftsmen. Therefore, except in the case of section foremen, section men, crossing watchmen and one or two other classes, the figures given by the Interstate Commerce Commission report with respect to the compensation and number of employees under the various classes did not mean very much. This has now been rectified, as explained elsewhere in this issue, by the United States Railway Labor Board, which has prepared an entirely new classification of all employees and officers in railway service, which classification has been approved by the Interstate Commerce Commission. Effective July 1, this will be followed by all the railroads in reporting wages, compensation and other data to the board and the commission, respectively.

THE COST OF TRANSIENT LABOR

IN YEARS gone by maintenance of way forces were recruited almost wholly in the smaller communities along the lines. These men looked to the section and bridge gangs as sources for regular employment and remained in service year after year. They provided their own homes, were self-supporting in every way, and their only claim on the railways was for their pay. During the last two decades this condition has changed and these men have gradually but steadily left the railways for other more remunerative service in other industries.

The result has been that the roads have been forced to

replace these men with others recruited in the larger labor centers. It has been necessary for the roads to provide these men with transportation to the work and on their arrival to provide them with living accommodations, arrange for the shipment of their food to them, and supply them with other living necessities. Since these men have been largely of foreign origin it has also frequently been necessary to provide an interpreter (who did little work) as a means of communication between the foreman and the men. All of these and other expenses made necessary by the employment of men remote from their homes have added to the cost of the work and are in reality a charge which should be added to the daily rate to determine the real cost of such labor in contrast with the native labor formerly employed.

The railways are largely responsible for this condition through their adherence to uniform rates and their failure to recognize the greater value of the resident laborer.

Their policy of uniform rates on divisions and systems has been fixed upon them still more firmly by the Railway Labor Board, which has established practically uniform rates throughout the country. Nothing will contribute more to the economy of maintenance work than a recognition of the fact that it is the aggregate of all of these items rather than the wage rate alone which determines the labor cost of work.

WATCH THE EXPENDITURES FOR LABOR

IN SPITE of the reductions in wages which became effective on July 1, the expenditures for labor will still be greater than for all other maintenance of way purposes. In 1920, 60 cents of every dollar spent in this department went for labor, in contrast with approximately 55 per cent prior to the war, while the aggregate expenditure for wages exceeded \$575,000,000, or at the rate of nearly \$2,000,000

per working day. Carried still further, this is equivalent to an expenditure of approximately a quarter million dollars per working hour. It should require no demonstration to prove the necessity for the most careful supervision of an expenditure of this magnitude.

Employing nearly one-half million men, the maintenance of way department has been one of the most extravagant users of labor. Purchasing only the cheapest, it has used it with a waste that has at times been appalling. With the wage rates, even after their reduction, still more than double those of pre-war days, the necessity of securing the maximum results is pressing. On no one does the responsibility for results rest as directly as on the foreman, for it is under his direct supervision that this labor is employed. In many localities conditions are such that the foremen can recruit their own gangs locally. While the rates of pay are now being reduced, they are still sufficiently high to enable the foremen to exercise considerable choice in the selection of their men and in

A NEIGHBOR

A railway is a neighbor to every resident adjacent to its lines. Its relation with these residents has much in common with those of neighbors in general. The maintenance of fences and of farm crossings, the continuance of the natural drainage and the prevention of fire losses are typical of many such mutual interests. A railway is a corporation with remote headquarters, but it is represented in every community by its maintenance foremen. These men establish the relations with the adjacent residents far more than the officers of the corporation. A road is judged by the attitude of these foremen in dealing with its neighbors, and it is popular or unpopular according as the foreman is liked or disliked. A friendly neighbor is an asset to any railway, but an unfriendly one can be a serious liability. A foreman who retains the good-will of those adjacent to the track while at the same time protecting his employer's interests is truly serving his road.

many places to secure men of a higher caliber than were available during the war. They owe it to their roads to take advantage of this condition and to replace the drones in their gangs with active workers.

Having secured the best labor available at the rates allowed, the problem then becomes one of employing that labor to the best advantage. It is here that some of the most serious losses occur. Lack of systematic planning of the work for the season as well as from day to day constitutes the greatest leak. The foreman who moves his gang from one place to another on his section throughout the day is at a great disadvantage in contrast with the one who plans his work systematically to avoid waste motion, and thereby secures the maximum results from every effort. When it is considered that the wage cost alone of the average section gang averages from \$2 to \$3 per hour, the importance of saving every minute is self-evident. Now when, as never before, they must get the maximum results from every dollar spent, it is important that every foreman exert himself to see that his labor losses are reduced to the minimum.

A GRAVE RESPONSIBILITY

AS REPORTED elsewhere in this issue, floods have been the source of enormous expense to the railroads during the past month, notably so in the state of Colorado. But flood troubles have by no means been limited to that locality. More recent difficulties are reported from Montana and North Dakota, and may occur at any time in almost any part of the country. Seasons of heavy rains and high water are always a source of great anxiety to the bridge supervisor.

No railroad may be said to have its structures in such perfect condition that their safety may be absolutely assured during such times without careful watching by those in immediate charge. Pile trestles will continue to be a standard form of construction for many years to come and considerations of economy will demand that certain so-called permanent structures be built on foundations of a type that cannot be considered absolutely secure against scour. Moreover, it is economically impossible to build structures for any commercial undertaking so that they will be absolutely secure against the unforeseen contingency. Nevertheless, trains must be operated and the responsibility must be placed on some one to determine when it is unsafe for the trains to pass over the structure.

This burden is usually placed on the master carpenter or bridge supervisor and through him on the higher maintenance officer who obviously is held responsible for the ability and judgment of his subordinate. To be able to pass with any degree of accuracy on the condition of a bridge during a period of flood implies a knowledge of what the water is doing to the structure at the particular time, and also a thorough background of knowledge of the conditions as they were before the water rose to form a blanket that conceals much of the physical surroundings, and of records of pile drivings, borings, etc., that will give the best possible knowledge of what the structure is standing on. Clearly, this comprises the most difficult feature of the bridge maintenance officer's responsibility. Because of its importance this subject should receive the widest consideration on the part of those who are directly concerned. With a desire to be of as great a service as possible to readers in this connection, the *Railway Maintenance Engineer* desires to present discussions of this subject by those who through personal experience have first hand knowledge of the difficulties which confront the bridge supervisor in fulfilling his responsibilities. It is the hope of the editors that this subject may receive extended discussion in its columns.

LETTERS TO THE EDITOR

WATERPROOFING BRIDGES

Kansas City.

TO THE EDITOR:

Referring to the article by A. S. Harrison in the May issue of the *Railway Maintenance Engineer*, regarding "Practical Methods of Waterproofing," I would raise two or three questions which have, as I see the matter, never been solved.

Paragraph two on page 165 states a truism—"It should have a proven life approximately equal to that of the structure itself." I cannot conceive of the conditions surrounding a bituminous coating which will prevent it from hardening and cracking nor which will prevent the drying out and ultimate destruction of a bitumen saturated membrane in a much shorter time than we should expect the decay of either a steel or a well built concrete structure.

Paragraph four, page 167, contains another truism—"The membrane is the waterproof drainage surface and provision for runoff from it should be provided. Failure to do this simply builds a pond on the waterproofing blanket." Any mastic, brick or concrete protective coating will inevitably crack and thus provide openings which will allow water to reach the waterproofing—that is, to provide small ponds, and, of course, these ponds will be sometimes filled and sometimes dry, thus insuring the decay of the bitumen.

In paragraph 10, page 167, reliance is placed upon the adhesiveness of asphaltic cement, when certainly that adhesiveness will be lost in time. The suggested methods of flashing and providing asphaltic cement joints at the curbs and at expansion joints are, I appreciate, the best that have been devised, but after all they are makeshifts, filled with grief and trouble, and dependent for their initial efficiency upon the utmost detailed care in their construction. The whole plan of waterproofing demands extraordinary care if it is to be made efficient, and we all know how hard it is to secure that care in the carrying out of field work; but I cannot evade the conclusion that the effective life of the best membranous waterproofing is short, compared to that of the structure it protects; and while it is the best we have been able to do, I am far from satisfied with it.

I believe that these opinions are rather common among the engineers who have struggled with the problem, and we are hopeful that those whose business in life is dependent on the success of waterproofing may yet devise a more satisfactory method than has so far been employed.

JOHN LYLE HARRINGTON,
Consulting Engineer.

Chicago.

TO THE EDITOR:

Referring to the above letter and the questions which the writer's article either raised or failed to answer, the question of whether the possible life of a bituminous membrane waterproofing system is or is not equal to that of the structure—steel or concrete—which it protects, would at once require that the possible life of the structure be determined and that the same be done for the waterproofing materials. In consideration of the first, we come, first, to the fact that the life of both steel and concrete—but particularly steel—is dependent upon the extent they are protected from the solvent frost and corrosive action of water, and, second, that the economic

life of the structure is affected by changes of conditions as to loadings, traffic routing and innumerable other factors. An indefinite life, therefore, can never be expected.

In regard to the possible life of bituminous materials, rather definite facts can be established. As to conditions of alternate wetting and drying and "drying out" of the bitumen, the conditions of roof construction meet this most commonly and with considerable severity. Built-up bituminous roofs 25, 30 and even 40 years old are not uncommon. Particularly in regard to waterproofing, I am personally familiar with many instances where a bituminous membrane system, under most severe and the widest range of conditions, has rendered efficient service for periods of 12 to 15 years without indication of deterioration. The practically absolute chemical and physical stability and freedom from deterioration of certain asphalts is, of course, a matter of historical record.

It would be pointless and inaccurate to argue a satisfactory life for all bitumens under the conditions described, or to attempt to prove that the opinions voiced above are uncommon or entirely inaccurate—bitumens, both coal tar and asphalt, are more or less affected by water, by evaporation of the volatile matter and also by interaction within their own chemical structure. It must be first recognized, however, that the term bitumen is generic and that between particular specimens wide variation in quality may occur, particularly as to weathering characteristics, depending upon the character of the source, method of refining and numerous other factors. To obtain best results, therefore, it is essential to give the matter careful consideration, and particularly with asphalts, to be specific and definite as to the particular material to be used. The usual standard physical tests will cover the physical characteristics and are important. However, as the chemistry of bitumens stands today, there is but one method by which the "weathering" characteristics of a bitumen can be foretold with absolute certainty; that is the time test, or a record of the particular material in service. This makes it particularly important to be specific.

I believe that the foregoing, particularly presuming the careful selection of the proper bitumen, indicates that the life of the existing bituminous systems may be essentially equal to that of the structure, or at least that the best of them is economically necessary to the development of the maximum life of a structure.

Charles A. Mead, bridge engineer, New Jersey State Highway Commission, in a paper before the New Jersey Association of County Engineers, states in part:

"Owing to the difficulty of making concrete entirely watertight, and as water is almost a universal solvent, it is of the utmost importance that entrance of water into any part of a structure be prevented. . . . Inaccessible parts should be protected by waterproofing, which is cheap insurance. With waterproofing cost at 2 per cent of the cost of the structure and money at 4 per cent, it is evident that if waterproofing prolongs the life of the bridge six months, it pays to do it."

In regard to the seal for flashing referred to, it is, of course, not entirely satisfactory. Wherever possible, the waterproofing should be carried above possible high water and be carried through to the spandrel or parapet. The designs suggested have proven efficient, however, in many instances, and the asphaltic seal has the redeeming feature of easy inspection and convenient and inexpensive renewal.

I agree that manufacturers of waterproofing must work to increase the efficiency of available materials, but not because all present systems are in any sense failures. Moreover, I believe that before generally or uniformly successful results can be had engineers generally

must give the problem more careful study and attention. I believe also that it is the function of the manufacturer to co-operate closely with the engineer and contractor and am convinced that a growing realization of the importance of the problem will insure these and make for increased waterproofing efficiency. A. S. HARRISON, Vice-President Minwax Company.

NEW BOOKS

Roadway and Track. By W. F. Rench, formerly supervisor Pennsylvania Railroad. 242 pages, 40 illustrations, 6 in. by 9 in. Bound in cloth. Published by the Simmons-Boardman Publishing Company, Woolworth building, New York. Price \$3.

This book treats of the practical problems of roadway and track maintenance. Its contents are drawn from the long and active connection of the author with maintenance of way matters, he having been for 25 years an employee of the Pennsylvania Railroad in its engineering and maintenance department and having been for many years a supervisor in direct charge of track maintenance on its most important main line. The books deal at length with the problems arising in the routine maintenance of track, such as ditching, ballasting and laying rail. It also discusses many of the less common problems, such as legal points affecting right-of-way and means of protecting slopes with vegetation. The several problems of the track have been presented with reference not only to the elaborate maintenance which is practiced on many main lines, particularly in the east, but also with due regard for that average maintenance which is applicable to the majority of roads. Special consideration has been given to labor-saving devices and methods in developing both roadway and track practice.

Track materials have been described in some detail, their proper use being facilitated by this knowledge as well as by the specific rules given for their application. The laying of rail, which is an item of track work where correct methods are of prime importance, has been developed with particular fullness. The detailed maintenance of main tracks and of yards has also been covered comprehensively. Chapters on maintenance problems and special duties in the maintenance of way department will be found valuable to those confronted with these questions. The idea of safety has been kept to the front in all discussions relative to work on or about tracks, while data abstracted from the M. C. B. rules concerning defective rolling equipment should prove valuable in the determination of accident questions. While written in simple language easily understandable by a foreman, the book should prove of equal value to the supervisor, division engineer and higher maintenance officers, particularly those who have not been brought into intimate contact with the practical details of track maintenance, but who are required to pass upon problems including the application of these methods.

SUPERVISORS' CLUB.—Roadmasters within 150 miles of Buffalo met at the Statler hotel in that city on June 18 to organize the International Track Supervisors' Club. This club, which is organized along lines similar to the Metropolitan Supervisors' Club of New York City, as noted in our last issue, will meet at frequent intervals for the discussion of problems of common interest to track men on various railways. M. J. Cooney, track supervisor on the Erie Railroad at Salamanca, N. Y., was elected chairman; W. F. Nichols, supervisor on the Lehigh Valley at Buffalo, N. Y., vice-chairman, and A. M. Clough, supervisor of track on the New York Central at Batavia, N. Y., secretary-treasurer.

ention.
acturer
tractor
the im-
ake for
ON,
pany.

ervisor
as, 6 in.
mmons-
uilding,

oadway
om the
mainte-
an em-
neering
many
enace
length
enace
ail. It
s, such
of pro-
ems of
only to
many
th due
licable
s been
eloping

detail,
dge as
cation.
where
en de-
mainte-
covered
ms and
nt will
ques-
t in all
while
ng de-
in the
ten in
an, the
, divi-
cularly
contact
t who
appli-

miles
n June
visors'
similar
York
ent in-
on in-
oney,
nanca,
rvisor
rman,
York

RAILROADS FIGHT COLORADO FLOODS

Heavy Rains Cause Enormous
Damage at Pueblo and Elsewhere



The Rushing Flood Scattered Destruction in Its Path

THE MONTH of June, 1921, will go down in the annals of Colorado history as the time of the great floods and of the Pueblo disaster in particular, where on the evening of Friday, June 3, the sudden rush of a great mass of water resulted in the death of several hundred people and the loss of many millions of dollars. The railroads were among the chief sufferers in property damage, which has been roughly estimated at \$5,000,000. Several hundred cars were wrecked or washed away, many miles of tracks were washed out, seven large bridges were destroyed or seriously damaged, several hundred thousand cubic yards of silt were deposited on railway property and large sums were lost in the form of revenues on business that could not be handled on account of protracted interruptions to traffic. The Denver & Rio Grande main line from Denver to Salt Lake City was cut in two, so also was the main line of the Colorado & Southern from Denver to Texas. The Santa Fe routes from La Junta and Trinidad into Denver were also interrupted, while the Colorado line of the Missouri Pacific was shut out of its western terminal.

While the Pueblo flood alone produced results that rank it among Great American disasters, there were in fact two floods of almost simultaneous occurrence on the east slope of the Rocky mountains which present characteristics that were similar in many respects. Both were of limited area and both involved heavy precipitation which, owing to the steep slopes, resulted in the sudden swelling of the streams, with consequent property damage, both in the immediate territory and later among the main rivers which received the water from the numerous drainage outlets.

In the case of the Pueblo flood the area of heavy rainfall was confined to the triangle enclosing Pueblo, Colorado Springs and Canon City. Owing to the fact that the characteristic rains of this territory are subject to extreme variation in intensity within short distances, it is impossible to determine what the average intensity or maximum intensity of the precipitation actually was. Therefore, the recorded fall of five inches at Colorado Springs on June 3 can only be taken as an index.

The result of the rain was a fearful rush of water down the Arkansas river flood basin and in somewhat lesser degree down that of the Fountain river, with terrible results at Pueblo on the evening of Friday, June 3. As this water moved on down the river further destruction of property and loss of life occurred. The approaches to the Santa Fe bridge at Nepesta were washed out for a considerable distance and large property losses occurred also at La Junta where the Santa Fe suffered also.

The other seat of heavy flood damage is the area en-

closing Greeley, Fort Collins and Boulder, although Denver also suffered to a minor degree. In this territory the heavy rains (4.4 in. was recorded at Longmont on June 3) caused heavy flows in the Big Thompson river, Rock creek, St. Vrain creek and other streams which washed out tracks and bridges at many points on the lines of the Union Pacific, the Burlington and the Colorado & Southern lying north of Denver to the west of the South Platte river. On the Colorado & Southern main line this was so serious as to interrupt service until June 10. As this flood water moved down the South Platte river it caused further trouble, washing out the Burlington bridge at Union, while occupied by a train, and creating minor troubles on the Union Pacific between Sterling and La Salle.

The railroads had scarcely had the work of restoration on the east slope well in hand before troubles of somewhat different origin were manifested in central and western Colorado. In this territory a period of protracted rain and warm weather melting mountain snows with unusual rapidity caused flood water troubles generally throughout the mountainous portion of the state, the Denver & Rio Grande being the chief sufferer. High water in the Grand, Gunnison, Animas and other rivers and their tributaries in the west and southwest sections gave the principal trouble. In the mountains immediately west of Denver, the Denver & Salt Lake and the Colorado & Southern line to Leadville were subjected to floods on June 13 which were so severe on the line of the latter as to result in a protracted interruption of train service.

PUEBLO AN IMPORTANT RAIL CENTER

Pueblo is second only to Denver as a railroad center in Colorado and is located at the center of a cross formed by double lines of railways extending to the east, west, north and south. To the north are the Denver lines of the Santa Fe and the Denver & Rio Grande, operated as joint double track and used by the Colorado & Southern as a tenant. To the south, the lines of the D. & R. G. and the C. & S. extending to Trinidad are operated as joint double track as far as Walsenburg. To the east extend the main lines of the Missouri Pacific and the Santa Fe, operating as independent single tracks, while to the west are the double track main lines of the D. & R. G. and the Canon City branch of the Santa Fe. In addition, the Colorado & Southern has a line extending north along the east side of the Fountain river which has now been abandoned for all but local or industrial use.

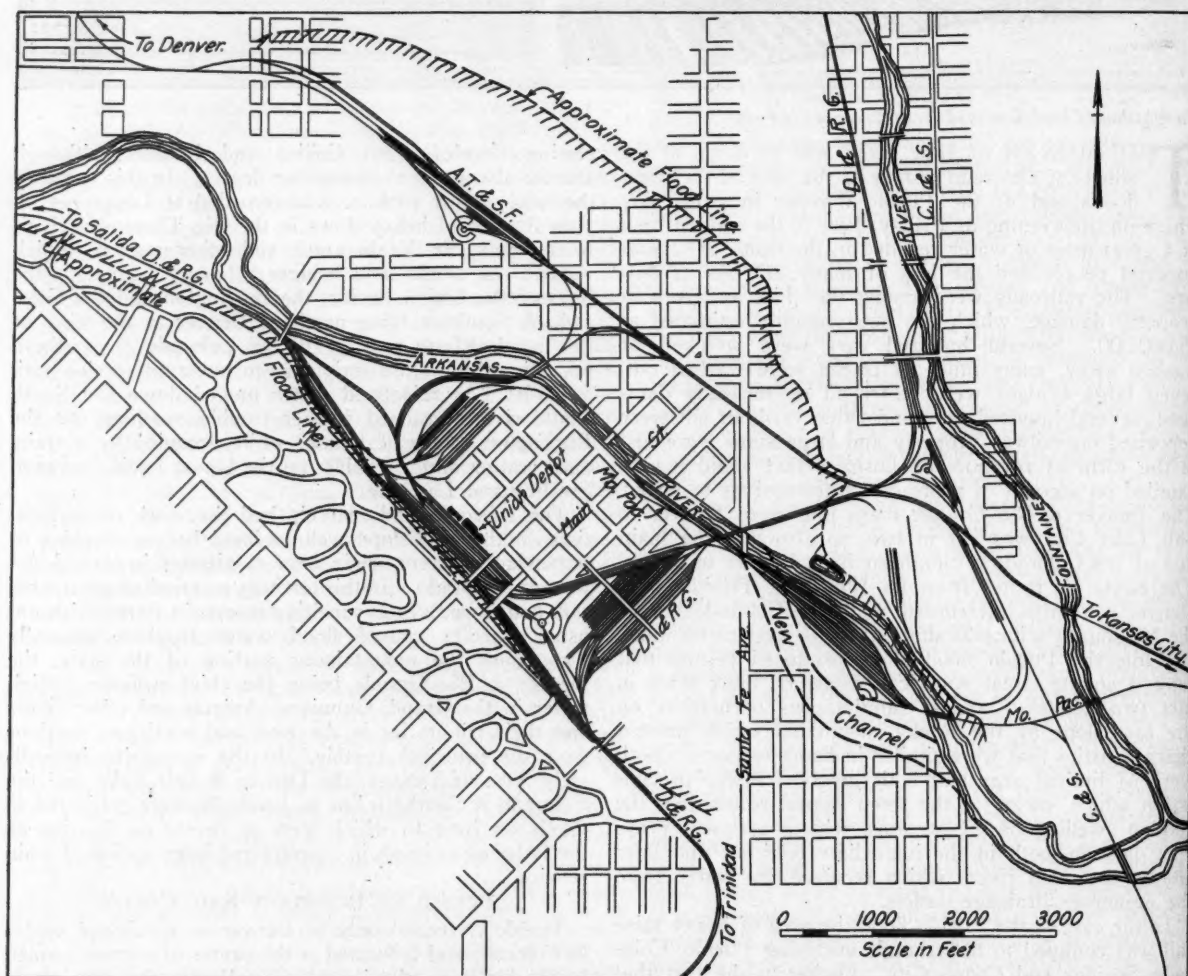
The terminal development within the city is characterized by the complexity typical of American cities. The D. & R. G., the Santa Fe and the Missouri Pacific have

independent terminal developments located generally parallel to the direction of the Arkansas in the lowlands on each side of that river. Those of the D. & R. G. are considerably the largest. The Colorado & Southern has a small terminal on the banks of the Fountain river. There are also connections which provide for the common use of the Union station by all the railroads. The entrance of the roads to Pueblo involves eight river crossings, three over the Fountain river and five over the Arkansas.

PREVIOUS FLOODS OF FAR LESS VOLUME

The flood of June 3, 1921, was not entirely without precedent. In 1894 the Arkansas river overflowed its

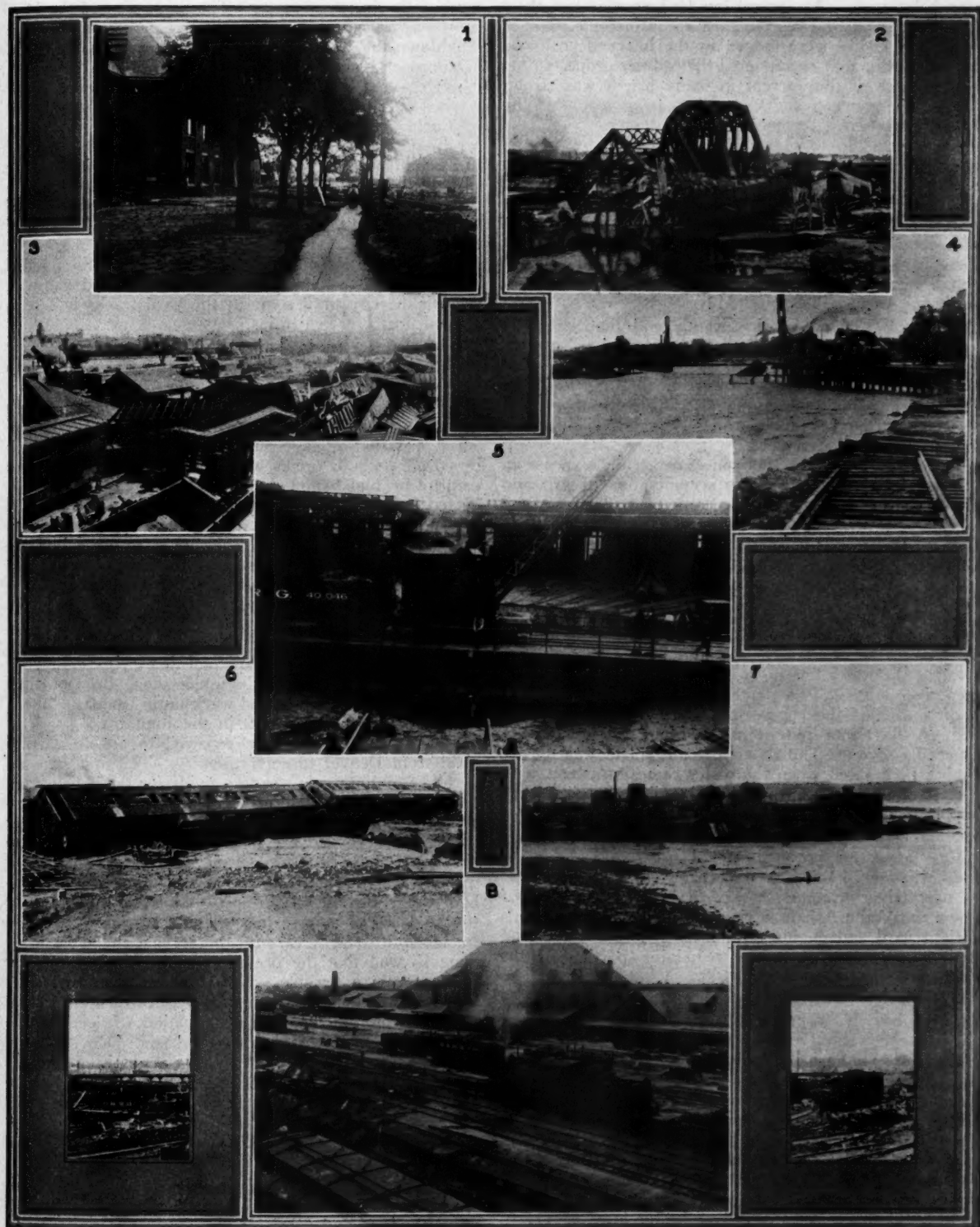
of them were washed away by the debris carried along by the water. The greatest width of the overflow through the town was $1\frac{1}{2}$ miles, the average being about 1 mile. The depth of water was approximately 13 ft., tapering off to the north with a gradual upward slope of the ground. It was 8 ft. deep over the Union station floor. There is no measure of the velocity of the water, which was far greater than that experienced in such great inundations as occurred in the Miami river valley in Ohio, as evidenced by the enormous damage done through pressure of the moving water and enormous force which floating materials exerted on anything interposed in the path of their movements.



Where Pueblo Suffered from the Flood

banks to the extent of covering the floor of the Union station to a depth of 18 in., so when warning was given about five o'clock on the fatal evening efforts were made to pick up all perishable goods in the restaurant and elsewhere about the station so as to be out of reach of water of approximately that maximum level. The great rush of water came between 7 and 8 p. m., and with such rapidity and at a height so far above anything anticipated that many people were caught on the streets or trapped in the houses. Two trains, one of the Missouri Pacific and one of the D. & R. G., were overtaken by the rush of water while trying to escape to high land. The cars were overturned and as the passengers and crews endeavored to crawl out on top of the cars many

Where the velocity was greatest the effect was to scour, with the result that tracks were washed out and bridge piers undermined and bridge embankments destroyed like dams from the water overflowing them. It was through these causes that all of the bridges but one, the west Arkansas river structure of the Santa Fe, suffered loss of one or more spans or portions of their approaches. In places where the force of the stream was broken or diminished, enormous deposits of mud were formed that covered the tracks to a depth of two feet and even more. In many cases this consisted of the sediment of the river waters, but in others it was mixed with vast amounts of debris of all kinds, including grass and other vegetable matter, trees, dead animals and al-



FLOOD HAVOC IMPOSED VARIED SALVAGE ACTIVITIES

(1) Shoveling a path through deposit of silt at the Union station. (2) D. & R. G. (left) and Santa Fe (right) bridges over the Arkansas river at Santa Fe avenue. (3) Havoc wrought by the rushing waters in the D. & R. G. yard. (4) Driving 1500 ft. trestle to take the place of the Santa Fe's Fountain River bridge. (5) Cleaning up the mud in the D. & R. G. roundhouse. (6) Cars from one of the ill-fated passenger trains. (7) The "island" yard of the Missouri Pacific. (8) Cleaning up at the Union station.

most every conceivable object to be found around human habitations. As several hundred persons lost their lives, it was to be expected that a considerable number of human bodies were lodged in the heavy deposits of foreign matter that encumbered the railway property.

The force of the current in many places was strong enough to overturn and even float away many of the 2,000 freight cars occupying railway property in the flooded area. In the D. & R. G. yards alone 467 cars were overturned. Of the cars in the Missouri Pacific terminal 100 were overturned and from 100 to 150 were floated away. The Santa Fe line north of the river was subjected to especially swift current and a large portion of the cars were floated off the right of way. Many of these car bodies will never be salvaged, as they were deposited so far away from any track that the cost of retrieving them will be prohibitive.

Both the Denver & Rio Grande and the Santa Fe lost bridge and building material from local yards; great quantities of ties, piles, creosoted bridge timbers and building lumber of all kinds were floated away. Near the Union station a large quantity of heavy timbers did serious damage to one of the city street viaducts by lodging against its supports.

One great source of annoyance, delay and expense in the reclamation work was the accumulation of grit and silt in the moving part of the equipment. The journal boxes of all cars had to be cleaned out and repacked before the cars could be placed in service. The air brake equipment also gave trouble from the same cause.

ENGINE TERMINALS WERE HEAVY SUFFERERS

The railways were put to enormous expense by the accumulation of mud and debris at the engine terminals. Water flowing through the roundhouses to a depth that brought the water line up to the cab windows of the locomotives left silt to a depth of a foot or more on the floor and filled the engine pits and turntable pits level full. At the Santa Fe terminal the water conditions were especially severe. The water softening plant was set fire by heat generated when the water came in contact with a store of unslaked lime. All of the oil in the oil storage supply floated away and became coated over cars in the vicinity.

One freak action of the flood was the isolation of the Missouri Pacific terminal by the formation of a new river channel, so with the destruction of one span of the Arkansas river bridge of this road, this freight yard and engine terminal was left on an island entirely separated from the remaining portion of the property.

The bridges used by the railroads to enter the city suffered heavily. The two-span, double-track bridge of the Denver Rio Grande over the Arkansas river at Santa Fe street was virtually destroyed by the washing out of the south abutment and the pier. The adjacent span of the Santa Fe was not injured, but about 200 ft. of the north approach was entirely washed away and, as shown in the illustration, a great pile of debris was accumulated against the north abutment. As stated above, the Missouri Pacific bridge over the Arkansas lost its west abutment and a 64-ft. girder span, while the Colorado & Southern, Arkansas river bridge lost one 112-ft. span and about 1,400 ft. of south approach. On the Fountain river a bridge of the Colorado & Southern had several spans carried away, the Santa Fe bridge was taken out entirely, while the Missouri Pacific bridge lost 400 ft. of its east approach embankment.

Besides the bridge failures, the railroads entering the city suffered such heavy damage that the city was en-

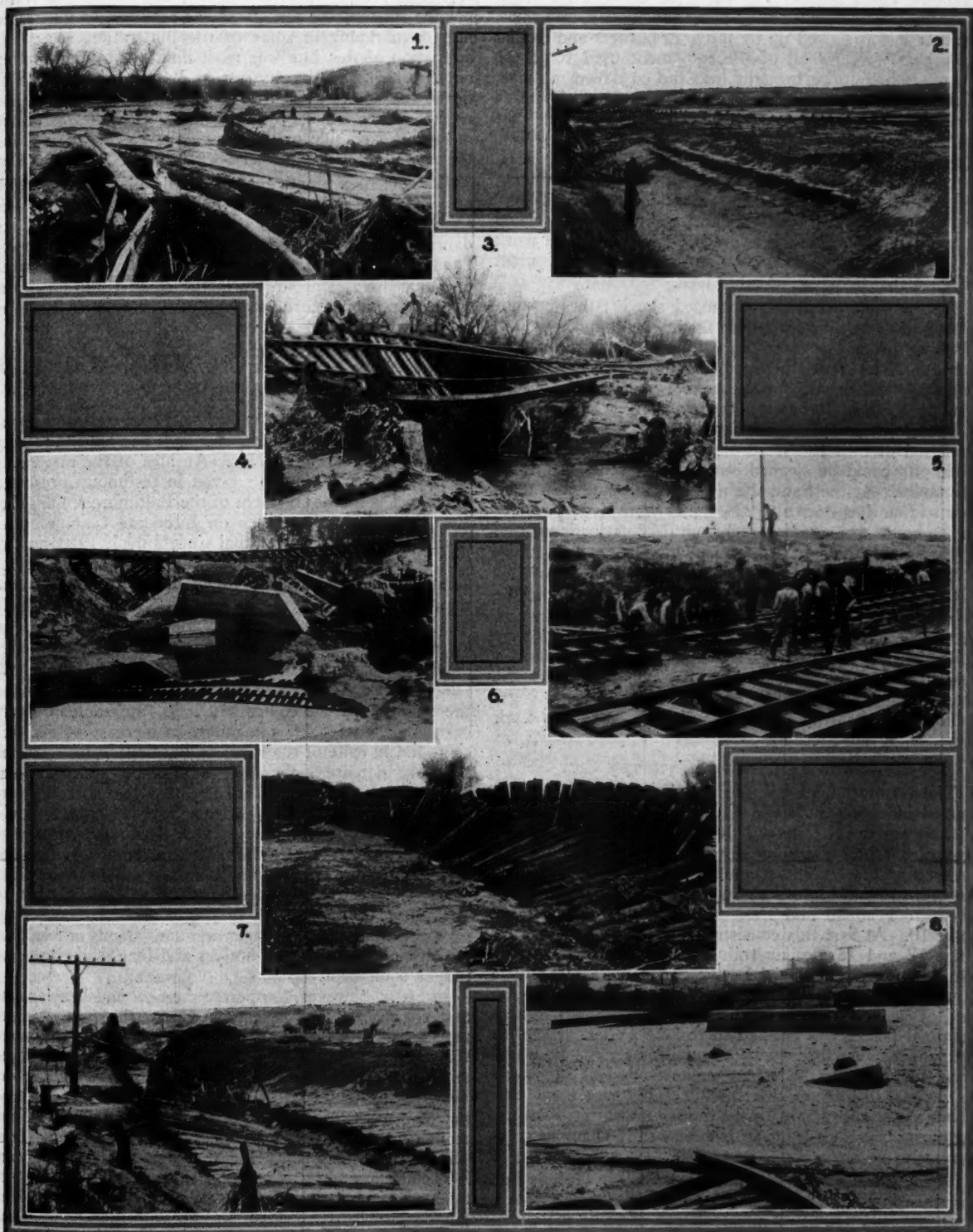
tirely without railroad communication with the outside world following the disaster. The Santa Fe and the Missouri Pacific were subjected to high water conditions further down the Arkansas river, the latter losing 2,500 ft. of approach embankment at the river bridge at Nepesta. The Denver & Rio Grande line west to Salida was badly washed out at many places in a distance of 20 miles west of Pueblo. Considerable damage to this line was done on Sunday, June 5, following the breaking of a dam of the Schaffer reservoir. Both the D. & R. G. and the Colorado & Southern lines suffered some damage between Pueblo and Southern Junction, two miles out of Pueblo, but both of these lines were uninjured south of that point, where they are operated as joint double track. However, lack of suitable terminals outside of the flooded area on these two lines made them of limited value in serving the city until some of the yard tracks had been cleared up to receive trains.

The Denver & Rio Grande line north along the west bank of the Fountain river was cut by side wash at two points near the northern limits of the city of Pueblo for a total distance of about three-quarters of a mile. North of Bragdon, the southern terminus of the joint double-track operation of the Santa Fe and the D. & R. G., line into Denver, both tracks were subjected to more or less damage by high water, but as these two lines are connected at intervals by crossovers, it was possible to make minor repairs that enabled the opening of one through line using portions of each track so as to come into the Santa Fe's Eighth street yard at Pueblo, the only yard in the city that was in condition to receive cars.

RAILROADS TAKE UP WORK OF RESTORATION

The flood waters receded slowly on Saturday, June 4, and it was not until Sunday morning that very active work in the salvage could be undertaken. In fact, little could be done in the railroad work until Monday, June 6, when enough of the breaks in the joint track south of Colorado Springs had been repaired to enable a relief train from Denver to enter the city. The first step undertaken by the roads was to provide for the housing and feeding of the men employed. The accommodations provided were crude at first, but as the work became better organized the men were well taken care of. Owing to the fact that there was a suspicion of contamination of the city water supply, the railroads arranged quickly to haul water into the city from Colorado Springs. Owing to the lack of any regular water cars, the Santa Fe steamed out some oil cars for this service, this work being done so well that the presence of the oil in the water was scarcely noticeable. Local labor was used very largely, comprising the men who were thrown out of employment by the temporary stagnation of local industries. Some men were also imported from Denver. Upon evidence of unrest or threatened competition for the available labor, a conference was held with the local authorities and a standard rate of 43 cents an hour was agreed upon. Under the authority of martial law this was established for all employment on relief work within the military limits.

The work within the city consisted primarily of salvaging the overturned and wrecked cars and of clearing away the mud and debris so that the tracks could be restored to service. In the yard of the Denver & Rio Grande east of the Union station, where the tracks are largely at right angles to the direction of the current, the tracks were badly washed and an enormous amount of work has been required to restore the tracks of line and service. The righting of cars required the use of a large number of wreckers, while the removal of the mud and



THE FLOOD DID GREAT DAMAGE BEFORE IT REACHED PUEBLO

(1) Mud and debris bury Santa Fe track and trestle. (2) D. & R. G. double tracks bottom side up and buried. (3) Track lifted over the girder by the rushing water. (4) All that is left of a culvert. (5) Cribbing up track washed out in a cut. (6 and 7) Two examples of "cork-screwed" track. (8) * Three span girder bridge over tributary to the Arkansas River carried away.

debris was best accomplished by the use of locomotive cranes. The mud was dug out from between the track rails and around switches by hand and thrown into piles, whence it was picked up by the grab buckets and loaded onto cars. Nearly all of the equipment used for these purposes had to be brought into the city from outside. There was not a single wrecker at Pueblo at the time of the flood. Consequently, the first equipment could not be brought until Monday, June 6, when the Denver line was opened, but following the opening of the D. & R. G. line to the south on Wednesday, the eighth, equipment could be brought in from that direction as well. Where the mud contained much foreign matter, especially when it was large pieces, such as trees, lumber, etc., the work of cleaning up was slow, but in general the equipment handled the debris remarkably well.

At the start the work proceeded slowly; the locomotives had to be dug out where they were found, put into working order and fired up with whatever means afforded. The roads worked together in this regard, utilizing each other's equipment whenever conditions made this advantageous. The engines in the roundhouses fared no better than those outside as regards the accumulation of filth and were of no service until the turntable pits could be cleaned out to permit the turning of the tables. At the Santa Fe terminal the mud was from two to four feet deep and 22 engines were tied up, either in the house or on radial tracks, until 20 carloads of mud could be excavated from the turntable pit.

The work was inconvenienced by a multitude of unfavorable circumstances. As all the oil supply at the Santa Fe terminal was floated away, it was necessary to secure a consignment of lubricant at once. The salvage of freight in freight houses and in cars was a difficult and arduous task which was greatly hampered by the loss of the car records. The presence of decaying vegetable and animal matter in some cases made the work exceedingly disagreeable.

RESTORING RAIL SERVICE INTO THE CITY

The restoration of rail lines entering Pueblo was conducted independent of the salvage work in the city. As the damage to the Denver & Rio Grande line to the south was of a minor character it was quickly corrected, and as soon as the Union station track had been cleaned up enough to handle trains through north and south service between Trinidad and Denver was restored on Friday, June 10. At first this consisted of special trains, but by June 12 and 13 regular train schedules were resumed. On June 11 the Missouri Pacific completed a pile trestle to take the place of the embankment washout at the east end of its Fountain river bridge and by using Santa Fe terminal tracks was enabled to resume passenger service on June 12. As the Santa Fe crossing over the Fountain river had been washed out completely, it was necessary to drive 1,013 ft. of pile trestle. This was completed about simultaneously with the work of restoration at the Arkansas river crossing at Nepesta, thus enabling train service to be resumed.

While the washouts on the Denver & Rio Grande line north from Pueblo to Bragdon did not interfere seriously with train service between Pueblo and Denver, the washouts on the Pueblo-Salida line were most disastrous to the traffic of that road, since it cut the Denver-Salt Lake City main line without possibility of detour other than the use of the Union Pacific line for the entire distance. The principal damage occurred between Pueblo and Canon City, where the main line of the D. & R. G. and also the Canon City branch of the Santa Fe occupy the alluvial flats of the Arkansas river. The tracks are bal-

lasted with a smelter slag, a very heavy material that serves to protect the embankment against serious wash, but the tracks were torn from the roadbed, as illustrated most remarkably in some of the illustrations. An examination of this line was most illuminating as pointing out the cause of the disaster at Pueblo. There is evidence that every tributary of the Arkansas in this territory carried an enormous volume of water from the mesas on each side of the river valley, completely filling the river bottoms, whence it was carried on to the city.

The end of a month finds the railways with the work of restoration well in hand, but considerable additional time will be required to eradicate all the signs of the damage caused by this destructive flood. The question of flood prevention by retarding dams in the Arkansas river or otherwise is still largely in the conjectural stage and hinges probably more on problems of finance than on those of engineering.

EXPENDITURES FOR NEW FACILITIES LOOM LARGER

FEW persons even in railway service realize the vast sums of money which a railway must expend to keep pace with increases in traffic. An idea of the magnitude of these expenditures was given in testimony presented by Daniel Willard, president of the Baltimore & Ohio, before the Senate Committee on Interstate Commerce recently, in which he stated that since July 1, 1910, and up to December 31, 1920, the Baltimore & Ohio spent for additions and betterments to its property slightly more than \$197,000,000. Of this amount \$98,000,000 roundly was spent for new equipment, and a substantially equal amount for new construction and additional facilities.

During the year ended June 30, 1910, the Baltimore & Ohio Company carried 13,870,883,868 ton miles. During the year ended December 31, 1920, the same property carried 21,661,448,095 ton miles, an increase of 56.2 per cent, and in spite of the large capital expenditure and the resultant increase of facilities, the Baltimore & Ohio Company was unable during the last fiscal year to carry currently all of the business which it was offered. It could not, in short, perform the service demanded of it as a common carrier. It is clear, therefore, that it had not increased its facilities beyond the reasonable requirements of its patrons. The expenditure of new capital by the Baltimore & Ohio during the period mentioned was approximately \$18,000,000 per annum, about one-half of which was spent for locomotives and for freight and passenger equipment.

In order, however, to operate the new and heavier cars and engines, it was necessary during the period under consideration for the Baltimore & Ohio to spend more than \$10,000,000 strengthening and rebuilding bridges and culverts, so that they might safely carry the heavier load. More than \$30,000,000 was spent during the same period for additional tracks, such as second, third and fourth running tracks, passing sidings, enlarged tunnels, terminal facilities, etc., for the accommodation of the heavier volume of traffic constantly offered. A total of \$9,200,000 was expended for new shops, shop tools and engine houses with which to care for the modern and larger power, while \$5,000,000 was spent for docks and wharves necessary for the prompt and economical handling of the larger volume of lake and tidewater business carried by the company, and \$4,600,000 was expended for new station and other buildings and for modernizing existing structures. The remainder of the principal sum was spent for telephone and telegraph lines, storage warehouses, paving, etc.



HOW CAN WE SECURE GREATER EFFICIENCY?

Six Maintenance of Way Officers
On Important Railroads in Various
Parts of the Country Present their
Ideas on this Timely Subject



NO PROBLEM is of greater importance to the maintenance of way department today than that of increasing the efficiency of its forces. This applies not only to the unit production of the individual laborer, but also to the direction of the work as a whole, so that the efforts of the laborer shall not be misdirected. Railway officers have generally realized that the output of the workmen has decreased seriously since the beginning of the European war, the reason being too well known to require discussion here. Realizing these shortcomings, considerable effort has been made since the return to private management and, especially since the decreased demand for labor, to restore efficiency in so far as this could be done by the individual efforts of the supervisory forces and it may be said that such efforts have been rewarded with a certain degree of improvement in the output of the men. However, there is a feeling on the part of some maintenance of way officers that the present period of more or less drastic readjustment offers an opportunity to start anew and put into effect general improvements that will be of permanent benefit. They feel that there should be a thorough analysis of the present inefficiency with a view of formulating forms of organization, methods and other measures which will improve the personnel, restore the old-time spirit and loyalty and inject new energy into the work.

That the ideas on this subject are many and varied is to be expected and such will be found to be the case upon reading the suggestions offered by the several contributions which follow. The reader will find from a study of these papers that the measures suggested may be divided into two classes, technical and human. The first involves the application or conservation of human energy in a way that will secure the most effective and economical results. The second relates to the influences which are brought to bear on the mind and spirit of the laborer so as to induce him to apply himself industriously. Both must play a part if true economy is to be obtained.

PROVIDE FOR TRAINING, WELFARE AND HUMAN CONTACT

BY GENERAL MANAGER

A GREAT AMOUNT of discussion now hinges on the relation between the past and present efficiency of labor, and there can be no doubt as to the existence of this factor. The absolute value of this ratio is admitted to be elusive, but by careful analysis it should be evaluated within reasonable limits, provided fundamental data are obtainable.

A résumé of the conditions leading up to present inefficiency of labor is illuminating. This condition began to be appreciable in 1915, when the European war was creating large demands for munitions and supplies. Most of the contracts which were awarded in this country carried large bonuses for speedy delivery. They had to

have the munitions and supplies regardless of the cost. The contract prices were generous, with the result that a mushroom industrial activity sprung up which could afford to pay its labor exorbitant prices and still have left wide margins of profit. The basic industries had to compete with these war industries which had put a severe strain on the available labor supply previous to the entrance of this country into the war. When it became necessary that the United States take up arms with the allies, the condition first noticeable in 1915 had become pronounced. Then our own war activities seriously reduced the labor supply through the draft, the shipbuilding activity and munition manufacture. This made the condition acute by virtue of the fact that the basic industries could not meet the wages paid by war activities, and what labor was still available was placed in a most independent position, resulting in complete demoralization. It was only natural that this demoralization should lower the working standards and morale of labor, resulting in inefficiencies.

The period from 1914 until the armistice was signed in 1918 was a period in which comparative values were demolished by dire need. It is not possible for a drowning man to place a commercial value on the piece of rope which effects his rescue. This was much the condition of this country, or even the world, during the war period. With the passing of this era we must fight back to normalcy and the relative values distorted beyond recognition by the battle of our existence must be re-established. This readjustment is difficult, but every individual must necessarily recognize the inevitable and meet it half way, and labor, which enjoyed the benefits of a demand far exceeding the supply, and which could therefore allow its productivity to be diminished, must contribute to its upbuilding.

DO NOT MAGNIFY THE DEFICIENCIES

The recognized inefficiency holds within itself potential dangers. When admission of this fact is forced, is it not apt to have a direct effect upon the supervisory personnel? Might it not be that when the inefficiency is taken for granted the psychic attitude of supervisors tends to magnify rather than diminish it? Does it not contain the necessary elements to make it a most convenient alibi for the man in responsible charge of the work from foreman up; and having conceded its existence, is there a sufficient effort put forth to circumvent its effect?

One contributory cause is the fact that direct authority under the present working conditions is circumscribed, which frequently prevents and generally delays discipline. In all labor we deal with the human element, which, within historical limits, has not changed perceptibly. Universally, a man in charge of men is respected in direct proportion to the authority vested in him, which is simply the allowed capacity for enforcing discipline.

It has been truthfully said that we get no more out of a thing than we put into it. Are we putting as much thought and energy into methods to improve the efficiency of labor as we formerly did, or have we become so imbued with the fact of labor's inefficiency as to stultify our activities in this direction? Efficiency of all labor lies in education and training. When conditions permit, labor should be carefully selected and then organized in such a manner as to train and educate it to perform the given work efficiently and economically. What any man does well he likes to do and takes a pride in the nice accomplishment of that thing. If men are taught to perform their work well their pride will be stimulated, with the result that better work will be done.

It should be recognized that a large percentage of people have limited thinking capacity. A small number must do the thinking for many. This is particularly true when dealing with the class of common labor. Therefore, careful and well-thought-out methods of supervision will achieve remarkable returns on the investment. The result obtained may be measured by the selection of the men, their education and training, and the relative philosophy of their supervision.

SOME SUGGESTIONS

To improve the existing conditions, the following suggestions are offered:

First: An organization or department to select men systematically for the work to be undertaken.

Second: Standard methods of education and training, to improve efficiency and to promote the general welfare of the men. From our labor must necessarily come our foremen, and usually from the foremen come the roadmasters. Therefore, the extent of our education and training of our labor ultimately reflects in the performance of our supervising forces.

Third: Personal records which will reflect a history of the individual performance, dealing with schooling, the work done previous to employment and performance subsequent to employment.

Fourth: Permanent employment. The attraction which work of any kind holds out to the steady laborer, and, therefore, the one we are most anxious to attract, is in direct proportion to the length of time which he can anticipate constant employment.

Fifth: Industrial insurance, covering health, accident and death benefits, at as small rates as are consistent with its own maintenance.

Sixth: Uniform pension rules, designed to take care of men grown old or incapacitated in the service.

Seventh: Wholesome influence on the thought of men tending to overcome or at least offset the effect of radical leadership, which they must be taught to know is not sound.

SHOULD STRIVE FOR BETTER ESPRIT DE CORPS

We should strive for contentment among our forces. Discontent is contagious and spreads like wildfire. Only contented labor will function efficiently. This should be accomplished with the facilities suggested above; and under the suggested conditions as men grew older in the service the bonds of relationship would become stronger and produce a loyalty which would not otherwise be procured. Personal contact between the men, their direct supervising forces, and fair play on the part of officials are the greatest assets a railroad management could have. The supervisory forces should be of a caliber to make labor feel its important place in the machinery of a railroad, recognize that place and realize the intrinsic worth without exaggerating it.

PROVIDE A BONUS SYSTEM

BY A TRACK MAN

IT IS COMMON knowledge that during the war period, and especially during the period of federal control, the efficiency of the forces in the maintenance of way department dropped to the lowest point ever known on American railroads. It is probable that the primary cause of this was the scarcity of labor and the ability of almost any man to step out of railroad service and secure higher wages. Another factor was the unrest that existed among all workers and which led them to make changes rapidly, frequently for no cause other than a desire to move. Still another factor, and probably an important one, was the very general attempt made to organize the maintenance of way forces under the American Federation of Labor. The reasons given for such organization were frequently far from facts and at times appealed to motives that were detrimental to discipline and the peace of mind of the prospect.

The scarcity of labor has of course disappeared, and with the inability of men to move around or to even secure work there has been a very noticeable increase in efficiency among common labor. Most roads feel that their labor was from 60 to 70 per cent as efficient during federal control as in the pre-war period, and it is probable that at the present time the efficiency of common labor is nearly back to what it was before the war.

RESTORE LOYALTY OF THE FOREMEN

With regard to the foremen, it is my belief that inefficiency still exists and that they have not recovered nearly as much of the ground lost as has common labor. I believe that the continual agitation in regard to unionizing maintenance of way forces, with the present uncertainty as to future wages and working rules, is partially responsible for this, and until the entire matter is settled so that the bulk of the workers on the railroads have accepted and have accustomed themselves to whatever reductions and changes in rules are made, we will not be in a position to secure the full benefit of any program that attempts to increase efficiency.

It is my belief that even under the conditions existing before the war there was room for improvement in the efficiency of the work performed by maintenance of way forces, and on the assumption that the foreman is the pivot of the units used in this department I believe that the first thing to do is to secure the co-operation of the foreman. Years ago I believe his loyalty and his interest in his work was much above the average railroad employee, but I am of the opinion that of late he is becoming more indifferent and less interested in securing results. The reasons for this are probably due to the fact that he has never been fully appreciated and has sometimes been underpaid. In addition to this, and possibly springing out of these conditions, is the fact that the character of the men now being made foremen is not as high in point of intelligence, ability and loyalty as it formerly was. I believe, then, that any marked future increase in efficiency will have to be made by increasing the average intelligence, loyalty and ability of the foreman, and that this can be accomplished to some extent by some of the following methods:

First: By regular meetings of the foremen on each division presided over by some of the division officers, preferably the division engineer, whereby matters of common interest may be freely discussed and the foremen given an opportunity to express their views as to ways and means, and as to methods used in carrying on work.

Second: By providing each foreman with sensible rail-

road literature, such as contained in the columns of the *Railway Maintenance Engineer*, and thus counteract some of the literature now being placed before them.

Third: By establishing a department, especially on the larger railroads, whereby the foremen may receive instruction in the common branches of education or on practical railroad subjects by correspondence.

Fourth: By establishing a system whereby the forces in the maintenance of way department would be paid on a piece work basis.

PROVIDES A REAL INCENTIVE

In regard to the last I have in mind some such system as has been developed by Mr. Stimson on the Baltimore & Ohio. I am convinced that with the small units working independently and with supervision at best inadequate, the temptation to lax methods and small output is very great. It should be remembered that there is only one man, the foreman, against the 6, 8 or 10 men in the gang, whose natural desire is to do as little as possible, and it takes a pretty strong man to stand up against it. Recognizing the fact that there is a determined attempt to have the foreman transfer his interest from the management to an outside organization, which we may as well frankly recognize as frequently encouraging a lessened output, it seems that we have simply got to insure the interest of the foreman being centered on production. I believe that under present conditions this can only be done by appealing to his very natural and normal desire for higher wages. One advantage that this would have at the present time would be that if a fair bonus system were established there would be some hope of getting the maintenance of way forces to agree to rules covering working conditions and rates of pay, and thus avoid the necessity of going before the Labor Board on an appeal. It seems to me that all the moves that are now being made simply drive the men farther and farther into the union. Believing, as I do, that neither the interest of the railroads or of the men themselves are being served in this way, I think everything should be done that can be to avoid encouraging the men to strengthen their organizations.

One good thing about the bonus system is that it calls for adequate and accurate cost data and automatically places it not only with the supervisory force but clear down to each man in the gang, and he is daily impressed with the fact that there is a very intimate relation between wages and work. This very fundamental economic principle has been ignored long enough, and it is time that every man, whether worker or a member of the supervisory force, has this driven in, so that it becomes a part of his everyday thinking.

NATIVE OR ACQUIRED ABILITY IN HANDLING MEN THE FIRST ESSENTIAL

E. R. LEWIS

Office Engineer, Michigan Central, Detroit, Mich.

THE RESULTS obtainable from labor employed in railway maintenance of way depend on the man, on his wage as compared with other classes of labor, on the conditions under which he works, on the tools, materials, equipment and supervision provided, and on the program, in the accomplishment of which the employee is the unit of labor of the railway company.

The efforts of an organization may be largely nullified if the program is not justified or if the methods of procedure are not of the best. It is true, too, that some measure of comparative performances is essential to a

knowledge of how much in the way of results is to be expected under given conditions; and these units of measure are not at present available. Nor will they be available until a common method of performing work is adopted by the organizations involved in the investigation. Engineers have shown the tendency at times to be too minutely particular about proposed units of measure, instead of being satisfied to accept averages and to overlook negligible inaccuracies.

MUST HAVE GOOD SUPERVISION

While the results of these investigations cannot be made available for some time to come, the personal equation, which after all is the most important, should be possible of early solution by anyone of authority having sufficient interest to apply himself assiduously, taking the matter in hand without fear or favor and with the determination to get results. He who would succeed must first sell himself to his own proposition. He must recognize that, while labor is not a commodity, it should be used in the wisest way to accomplish certain definite ends of mutual benefit.

It has been said that from his neck down a man is worth the minimum price for common labor. It might be added that the supervisor of labor who accepts workers at that value is not worth a great deal "from the neck up." The efficiency of labor depends on all hands working together both ways from the neck. It depends especially on the wise handling of men by overseers and officers, who must be afforded the time and the opportunity and who have the patience, the observation, the understanding and judicial insight into human nature to so guide their employees as to interest them in the results of their individual efforts. There is nothing impossible nor abstruse in this attainment. It does not require the employment of supermen to supervise. But it does require organized, thoughtful, concentrated, continuous attention. It involves the strict elimination of carelessness, of indifference and lack of a fine persistence in the pursuit of those objects which are of benefit to the department. The inefficiency of one laborer may not be a serious matter, but the heedlessness of a foreman, or the lack of foresight of an officer, adversely affects all those under his charge to whom his attitude is apparent.

Propositions considered with a view to ultimate maintenance economies are usually those which involve more than nominal initial expenditure. But here is a possible nation-wide economy, demanding practically no initial expense, affecting all our maintenance labor, which, as measured by annual outlay, amounts to slightly more than the total value of the rails and ties and all other maintenance materials used; an economy which in its practice is an asset from the start to each individual concerned as well as to the company. It involves only an expenditure of care, of thoughtful planning, of increased personal contact with one's fellow men, an expenditure of the powers of observation, of selection of the right man for the right place, and of judicious application of that pressure of personal influence which instills energy and produces purposeful effort.

THE PERSONAL EQUATION

When "pep" is lacking in a maintenance of way department, it possibly may be the result of some changing condition of the labor market or the food supply or immigration laws; but the chances are usually ten to one that the real trouble will eventually be found in the organization itself. The remedy lies in education of the supervisory and official staff in that peculiar faculty known as the handling of men. A great deal may be done

by the judicious selection of men for all maintenance of way positions. But for the reason that few men are born leaders and that many are lacking in this desirable quality chiefly through thoughtlessness and lack of observation, education can do a great deal to improve labor handling. A mere calling of these matters to the individual's attention is a helpful first step, while continued combined and concentrated effort toward the solving of the personal equation by all concerned tends to call out the best there is in the available labor for the company's interests. This elimination of the impersonal means the promotion of understanding between employer and employees, between the management and the rank and file.

The interest which the men take in their daily work is based on the knowledge that it is necessary to progress, that they have a part in the business of transportation, an organization which is vital to our twentieth century civilization.

TRIFLES MAKE PERFECTION

By J. W. POWERS

Supervisor, New York Central, Rochester, N. Y.

THOSE who have followed closely the amount of work accomplished by laborers during the war period fully realize that it is much less than that accomplished in former years and that in many cases the output per man was from 30 to 50 per cent less. However, it is true that a big improvement is noticeable in recent months, so that at the present time, under proper supervision, with a systematic method of executing all work, we believe that as much is done at the present time as was accomplished during the pre-war period.

In many cases, however, there is room for improvement, and by studying the situation carefully it is possible to adopt methods which will be of permanent benefit and will aid us greatly during this period of readjustments. Present conditions demand that maintenance of way officers study each detail of the work in which their forces are engaged, to distribute the money allotted for material and labor where it will yield the best results.

One of the greatest problems confronting supervisors or roadmasters is that of training laborers to fill the responsible position of section foreman. There seems to be a demand for a more thorough and better training than that which is given to men who are being prepared for section foremen on many railroads. It has been said that a good section foreman is cheap at any reasonable price, while a poor foreman is so expensive that a railroad company cannot afford to hire him at any price. Never were words more wisely spoken, and still the disregard to the above quotation has and is costing many railways thousands of dollars annually.

We do not believe that sufficient attention has been given to provide means for the proper training and selection of section foremen. However, some of the methods employed are worthy of careful consideration, and one method, which has proved satisfactory, is to select the best man on each section and make him assistant foreman, giving him a higher rate than that given to the other laborers. This man should be examined occasionally by the supervisor or roadmaster regarding his knowledge of the duties of a section foreman. He should also be permitted to perform some of the duties of the foreman to endeavor to determine whether or not he is possessed of the proper qualifications.

The opportunity of developing his capacity, as already stated, should be given the assistant foreman some time before promotion. While it is true that judgment develops with practice, it is better that he should be

given an opportunity of performing the duties for which he has been prepared while he is still in the ranks, so that when the appointment comes he is prepared for the greater responsibility.

FOSTER LOYALTY

Through the progress of organization some railway officers and their employees have grown apart. Consequently, all foremen should be trained to see the relation which may and should exist between employer and employees, to the end that a more sympathetic feeling be obtained. This is necessary for proper co-operation, which in turn means greater efficiency. Those in immediate charge of work can do much along these lines by pointing out to employees in their charge that they are a part of the organization and by encouraging the feeling of security of a permanent position as long as they perform their work faithfully and efficiently.

An important factor in securing efficiency is that of permanent employment, because men who become accustomed to do any particular kind of work are more competent. Permanent employment will also enable foremen in many cases to secure laborers locally, and men who are living at home are more contented and reliable and perform more and better work than the floating element. Laborers are human and appreciative of attention. Therefore, it is very essential that careful attention be given in providing them with good living quarters while in camps and boarding cars; also sufficient wholesome food furnished them, which will result in retaining a better class of men. It has been found in actual practice that wages are not the only consideration.

A sufficient quantity of good tools should be provided. The use of cheap tools, if of an inferior quality, is false economy. It is difficult to realize the unsatisfactory results derived from the use of a poor grade of tools, or tools that are not kept in good working condition. Therefore, foremen should be held strictly responsible for the proper use and care of them.

A SYSTEMATIC PROGRAM

System is one of the prime factors in securing efficiency, but owing to the diversified conditions encountered on many railroads it is impossible to adopt any system which will meet with requirements of all or even the majority of the roads. However, a well-defined system should be in force, and if necessary, modifications can be made to meet local conditions. In order to secure uniformity in a season's work, and to obtain the best results, section foremen on adjacent sections should begin at the point where their sections adjoin and work in opposite directions; work consisting of tie renewals, gaging, surfacing and lining; leaving the track worked over in first-class condition. This should be continued until the far ends of the sections are reached. The following year they should start on the opposite ends of sections. By adhering closely to this method there is little opportunity for wasted efforts and the supervisor can readily check and compare the work performed by each gang, which will result in a friendly rivalry between the respective gangs and will increase the output of work.

Another means for stimulating rivalry is a practice in vogue on many roads, consisting of annual or semi-annual track inspections and the awarding of premiums to foremen having the best sections on a supervisor's or roadmaster's subdivision. A few roads also give premiums to supervisors or roadmasters. If inspections are conducted properly and premiums awarded to those most deserving, the results obtained from this system are very satisfactory, but unless excellent judgment is exercised

in the distribution of premiums the result will be the opposite from that for which they were intended.

GANG ORGANIZATION

Gang organization is very essential for the proper execution of work. When possible, men should be selected to do the work to which they are best adapted. Good judgment requires that only a sufficient number of men be engaged in any kind of work to conduct it properly and men should be so arranged that they can perform the work to the very best advantage. It frequently occurs that in performing certain kinds of work two or more different departments are jointly interested, and in order that the work in question be expeditiously and economically conducted it is necessary that the most harmonious co-operation be obtained between the departments involved.

Conditions are changing so rapidly at the present time that the supreme efforts of today become the ordinary work of tomorrow. Such changes, however, by no means preclude the possibility of creating standards for certain classes of work which might be advantageously adopted by many, if not all, roads, thereby securing the all-important element of uniformity.

It may be said that some of the suggestions contained in this paper are mere trifles, but we should not forget that "Trifles make perfection, and perfection is no trifle." The greatest results are usually attained by simple means and the exercise of ordinary qualities which lie along the old highway of steadfast well-doing, and the officers who are the most persistent, and work in the truest spirit for the interest of their employers, are the most successful; for their acts are reflected on their subordinates and quickly mold their attitude toward the company they serve.

A GREAT MANY FACTORS TO BE CONSIDERED

By P. J. McANDREWS

Roadmaster, Chicago & Northwestern, Sterling, Ill.

A DISCUSSION of our problem and how to meet it should take into account the general situation rather than the few favorably situated lines or those in the more unfavorably located districts, because any solution that will help one will help all lines. With maintenance forces reduced to the limit during the past six months, and in many instances seriously disorganized, it would appear an opportune time to suggest changes to improve methods in maintenance of way work.

WAGES

Any solution offered must give consideration to wages, and we are told by many that a greatly reduced wage is the solution of our national ills. The writer, in common with many supervising officers in maintenance of way work, does not believe that classifying track labor as the lowest in skill and consequently the lowest paid class will help much to increase efficiency. Rather we believe that the men should be paid such a wage as will command the services of a fair share of high-class labor, let it be called common labor if you will. We do not mean, however, that in an attempt to compete with local industry we should raise the rates of pay here and there, but that the wages for track labor should range well up in the average with compensation for labor where similar skill and effort are required.

Wages cannot be uniform throughout the country without doing injustice to many employees, therefore national agreements, so called, or national wage scales are not workable and are unjust both to labor and to the em-

ployer. It is unjust to pay the laborer in the south, where a minimum of expense for fuel and clothing exists, the same wage as prevails in the north or west, where living costs are higher on account of climatic conditions. No one will dispute the right of labor to fair compensation, but to the practical maintenance man the national agreements, as we have them, appear burdensome and punitive rules granting overtime compensation on highly technical grounds ought to be abolished. An increased rate of pay to track laborers after six months' experience, with an advance at the end of each additional six months' service, until at the end of two years a maximum rate be paid, is recommended as a practical plan that will aid in retaining the best available labor and serve to compensate the employee on a basis of experience.

SEASONAL VERSUS CONTINUOUS EMPLOYMENT

In fixing wages consideration must be given to the probable period of employment during the year, continuity of employment having a bearing on the daily rate of pay. Therefore, in so far as practicable, the seasonal employment of labor should be discontinued and forces so organized that labor may be employed all the year round. Seasonal employment creates an abnormal demand for labor during the summer season, and has often caused a scramble that resulted in the retention of inefficient labor and was largely responsible for the granting of concessions to certain classes of labor that grew into abuses.

Through the extensive practice of seasonal employment unscrupulous labor agents have been able to exploit the laborer through charging exorbitant office fees and also defrauded the railroads through issuing free transportation for long trips on the pretense of shipping out laborers, but really conducting a cut rate passenger business, with the railroads furnishing the rides and the employment agent reaping the profits. The organization of a labor bureau with a capable personnel in charge and the adoption of an all-year-round program of maintenance would put some labor agencies out of business and increase efficiency.

TRAINING AND SUPERVISION

While it is claimed that education does not always increase efficiency, we believe that training does. Therefore, the training of the employees through proper supervision is essential to progress. Supervision has not kept pace with increased demands on maintenance organizations except in a few cases, this condition not being one of choice, but often resulting from the belief that the railroad could not finance the increased salaries for supervising officers. For example: On some railroads it is not unusual for a track supervisor or roadmaster to be charged with the duty of supervising a division where the pay roll will average \$500 to \$1,000 per day. It is believed that under such conditions additional supervision will be found economical and add much to efficiency.

In planning an organization care should be taken not to go to the other extreme and become top heavy through duplication of supervision. The specialist is often a necessary evil, but too many specialists on the same job do other damage than that of swelling the pay rolls. Two or more men should not be covering the same district where one may do the same work in the same length of time; therefore, combining certain departments will be found economical and practical.

Give each subordinate a specified district and hold him responsible for efficient maintenance in such district, with little red tape to retard the exercise of initiative, and efficiency will be increased. Close attention to details, measuring the product of the individual employee, apply-

ing quickly the best methods of performing work, weeding out the inefficient man and getting a fair day's work for a fair day's wage are essential to solving our problem.

THE USE OF MACHINERY

Machinery has not been used to the extent that it should in maintenance work. This comment is not intended as a criticism of the railway managements, but a simple statement of fact. The failure to use machinery in the past was due to an almost inexhaustible supply of labor (such as it was), and now that under normal industrial conditions the supply will be reduced, it is necessary to make use of every labor-saving machine or device which has merit. We might mention here the section motor car which has come into general use for ordinary maintenance work, also the larger gasoline-driven cars which are capable of handling a large gang of men on a car and trailers, and may also be used to handle material to an extent that will often render unnecessary the use of an expensive work train.

Power hoists for handling heavy material, rail laying machines, power-driven tie tampers and other labor-saving machinery are available and through their use efficiency will be increased. It is true that most railroads have already been equipped with some of this machinery, but a more general use is essential, and to make adequate advance the best thought in our ranks should be devoted to the development of labor-saving machines and appliances. Maintenance officers and their subordinates in conjunction with mechanical experts must see to it that the brains of a few will do the work that heretofore has been done by the hands of many.

MEETINGS, LOCAL AND NATION WIDE

The wide awake supervising officer will study methods for himself and the wide awake managements will use the best methods applied generally on their lines. Close association between the maintenance foreman and the supervising officer gives the latter opportunity for studying methods, and after satisfying himself as to the merit of any new method he will see to it that others practice it.

Meetings at which the division staff may exchange views serve a good purpose, but in the maintenance department a more general meeting is desirable. On some roads system associations are formed, having as members foremen, supervisors or roadmasters, and most of the higher officers of the maintenance department, the general meetings of such an association doing much to increase efficiency. We are entering on a new era and many changes in methods are sure to be made, and the men who will be first to see and act on ideas or suggestion to increase efficiency will be the ones to win.

Associations of maintenance officers, preferably formed in a strong national organization, meeting annually or oftener and with sections representing different geographical parts of the country, holding sectional meetings at which their own special problems may be discussed, will be found very helpful and should be encouraged by the managements. Never before has the need for intense activity on our part been so great and we must listen to every suggestion and give it consideration.

Before we get back on smooth track with 100 per cent efficiency we are going to find a few more bad spots over which we must proceed carefully, but with the determination that railroad men and not politicians are going to operate and maintain the railroads of our country, we must continue to carry on. If this is done we, who were often told of the loyalty and efficiency of our maintenance departments, especially the trackmen, may again see methods and organization thoroughly efficient.

WORK WITH THE FOREMEN AND THEIR MEN

By L. M. DENNEY

Supervisor, Cleveland, Cincinnati, Chicago & St. Louis, Indianapolis, Ind.

THE RESTORING of the one-time efficiency or loyalty that was enjoyed by the maintenance of way department is the one important question confronting officers of that department. The efficiency among the employees of the maintenance department did not break down in a day, but, like a lingering disease, it pulled the morale to a low level from which it will take some time to recover fully. A gradual improvement in the condition has been noticeable for several weeks, but what is wanted at this time is some definite prescription of methods which will nourish the improvement until the desired standing has been returned.

If the efficiency physician of the maintenance of way department could dictate a prescription which would bring about this change as by magic he would be the most valued man in the service, but since this cannot be done, he must prescribe some definite and wise principles which will promote increased efficiency until the department again heads the list of loyal employees.

With the laborer the plan of employing a definite force the year round instead of on a monthly basis would be an important factor. The men would then know that they had something definite ahead of them, instead of feeling that they had only a few days' work to look forward to. The paying of a graduated scale, varying a few cents per day to the man who has the ability to do more work, will also lead to extra effort by the lower paid man to produce more, and also the higher paid man to keep himself in advance in order to retain his rating. Where the housing of men is necessary, they must be cared for in such a manner that they will feel that the company, through its officers, has an interest in their personal welfare. This will develop a loyalty that would not be easily broken down.

Section foremen usually are selected from the more loyal and better educated laborers who show ability to do good work and handle a gang of laborers successfully. They have been evolved from the "section boss" of a few years ago to the standing of a "track foreman." To maintain a proper standing he should be placed on a monthly salary and thus distinguish him from the hourly men with overtime rates.

I know of no better methods of increasing the efficiency of this class of men than to educate them to a full realization of their responsibility to the position they hold and to the company which provides them a means of producing an honest living. Much good can come from an occasional meeting of all foremen at the office of the supervisor or roadmaster, where common questions can be discussed which will lead to a closer cooperation among the foremen and a better understanding for unified efforts.

The supervisor or roadmaster can do much to show the foremen the class of men they must employ by impressing upon the foremen the qualifications they themselves must possess. Teach the foremen that they must be prompt, observant, industrious and faithful to the company and respectful and loyal to their immediate superiors, and it will follow that foremen will employ only such men. These qualifications cannot more easily be taught the foremen than for the supervisor or roadmaster to show by deed that he possesses them. Give the foremen good examples and put it directly up to the foremen to produce results and the inefficiency will be cured.

THE REPAIR OF SWITCH STANDS AND LAMPS

Four Affiliated Railroads Maintain an Organization to Do This Work and Also Test and Distribute Oil

By B. J. SCHWENDT,

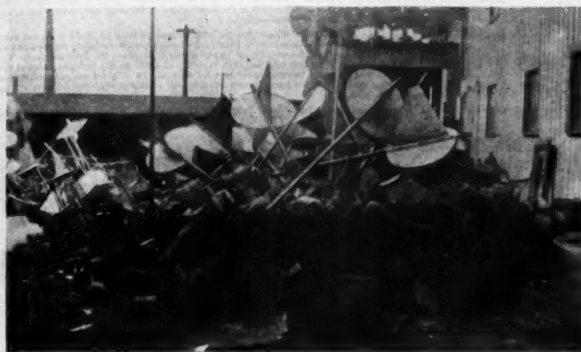
Superintendent Telegraph and Signals, Toledo & Ohio Central, Columbus, Ohio.

A SWITCH STAND and its lamp are essentially fixed signals. Therefore, there is sometimes a question as to whether they come within the province of the maintenance of way or the signal departments. On four railroads, the Toledo & Ohio Central, the Zanesville & Western, the Kanawha & Michigan and the Kanawha & West Virginia, they have been considered of sufficient importance from the signal standpoint that the maintenance of all switches and derail lamps and stands has been placed under the supervision of the signal-tele-

graphs to a stand broken or worn in service are not made in the field, but the defective stand is taken out and forwarded to the signal-telegraph department shop at Columbus, Ohio, being replaced in service by a complete outfit from the track supervisor's emergency stock. Each track supervisor carries such a stock, which is in proportion to the number of stands he has in service.

At the shop the stands are taken apart and repaired by supplying the missing part from another stand which was not so broken, supplying new parts only when the necessary repair part cannot be so secured. The stands are also trued up and centered and brought up to standard in every way. It is seldom necessary to purchase anything except a certain few repair parts and many of these are cast from company patterns at a local foundry, thus making possible an additional saving.

Broken or badly worn stands which formerly were scrapped are now being reclaimed and made as good as new at a total cost of 20 to 40 per cent of the price of

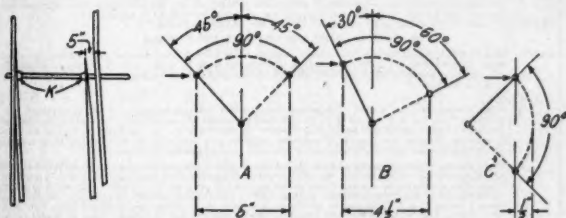


Switch Stands as Received From the Road

graph department. This department also has charge of the testing and distribution of the long-time burning oil used in the switch and signal lamps on two of these roads. With the concentration of this work under one department, a system of standardization for stands and



Switch Stands and Parts Repaired Awaiting Shipment



A-Lever on center adjusted for 5° stroke with 90° travel.
B-Lever off center 15°. Stroke reduced to 4½° with 90° travel.
C-Crank off center 90°. Effective stroke zero with 90° travel.

Diagram Illustrating the Effect of a Bent Lever Arm on the Stroke of a Switch

lamps has been developed, as a result of which some marked economies have been secured. For this reason many of the operations of the signal-telegraph department of these railroads as they affect the repair and distribution of lamps and switch stands are of definite interest to maintenance of way officers.

STANDARDIZATION SIMPLIFIES REPAIRS AND DISTRIBUTION

The supply of repair parts and the reclamation of switch stands and lamps has been greatly simplified by the standardization of switch stands; that is, the mechanism, latches, rods and all common parts have been made interchangeable on low, intermediate and high stands. Re-

pairs to a stand broken or worn in service are not made in the field, but the defective stand is taken out and forwarded to the signal-telegraph department shop at Columbus, Ohio, being replaced in service by a complete outfit from the track supervisor's emergency stock. Each track supervisor carries such a stock, which is in proportion to the number of stands he has in service.

At the shop the stands are taken apart and repaired by supplying the missing part from another stand which was not so broken, supplying new parts only when the necessary repair part cannot be so secured. The stands are also trued up and centered and brought up to standard in every way. It is seldom necessary to purchase anything except a certain few repair parts and many of these are cast from company patterns at a local foundry, thus making possible an additional saving.

Broken or badly worn stands which formerly were scrapped are now being reclaimed and made as good as new at a total cost of 20 to 40 per cent of the price of

new stands, and when turned out of the shop it is difficult to distinguish them from new ones. The stands reclaimed are placed in stock as new stands, ready for the next requisition from the track department.

The storehouse is adjacent to the shop and is under the direction of the supervisor of material and repairs. All accounting of material for repairs, including charges from stock, is completed at this storehouse, including the final accountings to the auditor.

One of the most common causes of injury to switches results from their being "run through." The sketch shows how the operating lever of a stand is affected by such an accident. This approximate "15 deg. off center," as it is commonly known in signal practice, causes a loss of stroke as is explained in the diagram, the exact amount depending upon the length of crank arm used, etc. This is corrected as the stands pass through the shop by heating the lever shaft at X, and twisting the parts back to the normal position.

On this and all other types of direct-connected stands, such loss of stroke throws the lamp and target out of line by a like angle, causing "bad" lamps. Under the old practice the section foreman was required to exercise his ingenuity to make the switch stroke match the reduced

switch stand stroke and this was usually done by inserting nut locks or washers between the tie bar socket and the switch point (see K in the diagram). However, usually the "out of line" of lamp and target was left uncorrected and the job called "done."

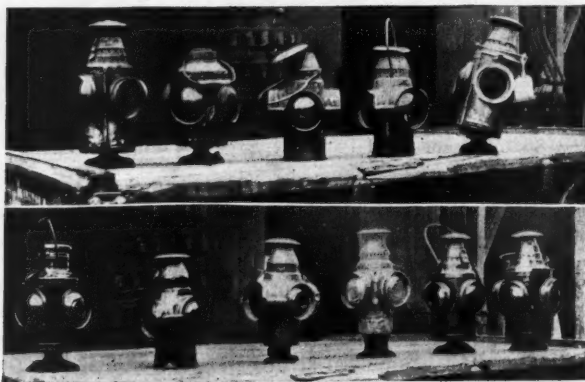
Under the new practice, such remedies are resorted to only until a correct stand is received from the supervisor's stock if one is not already on hand in the yard.

It will be noted that this system is quite flexible in that the reclamation makes it possible to use any of the old types of stands with new types in actual service without inconvenience to track men, or any sacrifice of service or expense. In addition, any special changes in lamp tips, targets or connecting rods or any change in standard can be carried out readily, as the stands pass through the shop with the assurance that they will be "right," as the work is done by mechanics under the supervision of men who understand and are interested in the work and realize its importance.

Detailed plans showing all parts of standard stands are on file with each division engineer, track supervisor and the supervisor of material and repairs, the chief engineer and the superintendent telegraph and signals. Such plans show the manufacturers' ordering number for each part, so that all persons interested are provided with a common means of preventing any misunderstandings. About once a year a representative of the signal department, co-operating with the track supervisor, makes a field inspection of switch stands and lamps and marks with red paint any which should be shopped, keeping a detailed memorandum of all cases to insure results from such inspections. The lampman's troubles are also investigated and corrections made.

SWITCH LAMPS

By centralizing the supply without sacrificing service or economy this system also reduces, to a great extent, the number of emergency stands that it is necessary to carry on the road and also insures uniform practice. It has



Switch Lamps Before (Upper) and After (Lower) Repairing

been in effect for five years on the Toledo & Ohio Central and the Zanesville & Western and one year on the Kanawha & Michigan and the Kanawha & West Virginia and seems to be meeting all demands of the service very satisfactorily and at a handsome saving per year. It has also played a great part in eliminating lamp failures and "poor lamps."

Like switch stands, all lamp repairs are made at the signal-telegraph department shop. Each track supervisor has a quota of emergency lamps based on the number of lamps in service in his district (usually 5 per cent). When a lampman or section foreman wires for a relief lamp, using the lamp number whenever in need of relief lamps,

the lamp is forwarded on the first passenger train, using a passenger train way bill. The defective lamp is forwarded to the supervisor, who examines it to insure that a correct exchange has been made and forwards it to the signal-telegraph department shop. On receipt of the lamp at the shop, the supervisor's quota is immediately filled by returning to him a like serviceable lamp. After the lamp is repaired, painted, inspected and tested, it is

THE TOLEDO & OHIO CENTRAL RAILWAY CO. THE ZANESVILLE & WESTERN RAILWAY CO.

INSTRUCTIONS FOR THE CARE OF LONG TIME BURNING SWITCH AND SIGNAL LAMPS

REVISED MAY 1, 1919

GENERAL RULES

CLEANING—

LAMPS must be thoroughly cleaned inside, and all soot must be removed from top cone and ventilator. LENSES must be kept clean and polished inside and out, and all substances must be kept out of lens grooves. Blow breath on lenses and polish with paper only. Wash with soap and water and a small amount of "Cold Duet" when necessary.

BURNERS must be kept clean at all times. When they become crusted or hard to clean or do not work freely, do not throw away but replace same from surplus stock and immediately tag the defective burners and send same to Storekeeper, Signal Department, Columbus, via Railroad Mail. Tag should show the number of section and whether T. & O. C. or Z. & W., and the name of the Section Foreman or Lampman sending same in. As soon as the burners are received by the Storekeeper, a like amount of good burners will be sent out immediately. No burners will be furnished on requisition.

CHIMNEYS must be kept clean at all times. Blow breath on chimney and polish with paper or clean waste only.

TRIMMING—

WICK should not be trimmed with shears, but the charred portion should be broken off with the finger, or with a steel, which is turned so that only the charred part projects from the wick tube. If the wick unravels at the edges during this operation, it can be slightly trimmed with shears. Wick must be trimmed at least once each week, and more often if necessary to keep flame in good condition.

FILLING—

FILL the font, (oil cup) within one-fourth inch of the top of cup, not collar, at time of cleaning. (NEVER FILL FULL). This allows space for expansion of oil when lamp is lighted. If the font is filled full and lamp lighted, the oil will be forced up, and will flood the burner, causing the lamp to smoke or possibly explode.

Once each month, the font (oil cup) should be emptied of all old oil and water accumulations.

NEVER RINSE FONT WITH WATER. Use L. T. B. oil when testing to locate leaks.

LIGHTING—

Raise the wick slightly above the wick tube and light; replace chimney and allow flame to burn low in at least five minutes, then raise wick slightly (about 1/2 inch) to give best results. Judge this from experience. If this is not done, the flame will at most times burn high and will soon fill lamp with soot and will encrust the wick causing failures.

SPECIAL NOTICE

OIL TANKS, CANS AND FUNNELS MUST BE CLEANED REGULARLY, and all deposits and other substances taken out. If this is not done, sediment will collect and spoil the oil and cause the lamp to go out. The caps provided must be kept on the cans and all plugs or bungs in supply barrel must be kept in place, when drawing out oil, to keep out the air and dirt. ALLOW NO WATER TO GET INTO THE CANS OR BARRELS.

CHIMNEYS must always be used on Long Time burners made for chimneys. If this is not done the flame will be unsteady and will smoke, causing poor service from lamps on account of soot, and the lamps will use one-fourth more oil in addition.

NEW WICKS. The wick carries the oil from font to flame and acts as a strainer for the oil. Unless the wick is thoroughly cleaned every two months it will become stiff and prevent the free flow of oil to the flame and the light will go out. Whenever this happens, the wick must be replaced by a new one.

NEVER USE WATER TO CLEAN PART OF THE LAMP EXCEPT LENS AND FUNNELS.

ORDERING OF LAMPS AND OIL, CANS AND FUNNELS.

LAMPS. All switch lamps used for switches or other purposes have their reference number stamped in center of top caps. In describing or ordering such lamps, this number must be used. If lamp becomes damaged and will not work properly, WIRE SUPERVISOR AT ONCE FOR A RELIEF LAMP, returning the defective lamp to him promptly.

L. T. B. OIL—

A. Notify Storekeeper, Signal Dept., Columbus, Ohio, DIRECT 30 days before oil supply gives out, using L. T. B. Oil Order Form No. S. J. 5-2 for this. He will then deliver the oil in time. Estimate this as closely as possible to avoid holding steel barrel after the new shipment arrives, as the barrel is needed for other shipments. If, after notifying the Storekeeper as above, it is found the oil will not last 30 days, notify Storekeeper at once how long it will last. These cases should be made as few as possible.

B. When the new supply is secured and the old exhausted, replace the steel barrel on the barrel-stand with the new supply barrel, (do not transfer the oil from barrel to barrel unless absolutely necessary), transfer the faucet from the old to the new barrel, put in and tighten the plugs of the old barrel and ship it by freight IMMEDIATELY TO STOREKEEPER, SIGNAL DEPT., COLUMBUS, OHIO, using regular bill of lading, Form T 249 for T. & O. C. shipments and Form 2 9 for Z. & W. shipments. MARKING ON THIS BILL OF LADING THE NUMBER OF THE BARREL. A copy of this bill of lading should be mailed to the Storekeeper, Signal Dept., Columbus, Ohio, at once.

C. Section Foremen and others are cautioned to use care in handling the steel barrels whether empty or full, in order to avoid damaging them. Steel barrels are very difficult to repair and must be handled carefully.

D. If steel barrels leak around the bungs, Foreman will tighten such bungs with wrench. If this does not stop the leaking, Foreman will take out the old gasket, put in a new one and retighten the bung. If the leak still continues and oil is being wasted, Foreman will wire Storekeeper, Signal Dept., Columbus, Ohio, for a RELIEF BARREL and on receipt of same will promptly return the leaky one as per "B" above, sending a letter along to Storekeeper with copy of Bill of Lading explaining where the barrel leaks.

OIL CANS AND FUNNELS. If oil can or funnel is in need of repair, Section Foreman will order new one from Supervisor, returning the defective one to him at once. Townsmen, Targetmen, and Maintainers will order from the Storekeeper, Signal Dept., Columbus, Ohio, and return the defective one to him at once.

ALL PERSONS HANDLING LAMPS WILL BE HELD IN STRICT OBEDIENCE TO THE FOREGOING.

Approved:

J. A. STOCKER, Chief Engineer.

E. A. HOLTSBERY, Div. Engineer.

B. J. SCHWENDT, Supt. Tel. & Signal.

G. H. SMITH, Div. Engineer.

Facsimile of a Poster of Instructions to Lamp Tenders

placed in stock as a new lamp and the transaction completed and accounted accordingly.

It was found that many "bad lights" and failures were being caused by lack of chimneys and by failure of the chimneys to stay in place on burners equipped with them. To overcome this, a special chimney holder, which may be applied to almost any long time burner, was developed and patented.

In a few cases such as yards, where lampmen have a great number of lamps, they are permitted to carry a few emergency lamps, but for all other points the track supervisor carries an emergency stock equal to about 6 per cent of the lamps in service. Experience has proved that this percentage is ample.

Each lampman is supplied with an emergency stock of burners, and no burners are furnished on requisitions. When a burner becomes defective it is replaced from the emergency stock and the defective one forwarded through the supervisor to the signal-telegraph department shop. Upon its receipt a good burner is returned immediately, thus again filling the lampman's quota of burners. Usually the defective burner needs only a good cleaning, which is done by boiling it in a solution of lye.

All lamps in the area covered by any lampman have the same type of body, therefore the oil pots, burners, etc., are universal and interchangeable. The new standard lamps are worked in on the portions of the road where the worst conditions of weather are encountered and the old lamps changed out to the other sections having more mild conditions. So far as possible, each track supervisor's district is equipped with only one type of lamp body. The supervisor of material and repair keeps a lamp record showing in detail the number and kinds of lamps and surplus burners on each lamp section, also a detail of each track supervisor's quota. As changes or rearrangements are made or sections added or removed this record is brought up to date with the co-operation of the track supervisors. This co-operation is further made necessary by the accounting done by the supervisor of material and repair. On the Toledo & Ohio Central and the Zanesville & Western, this system was placed in effect in 1911 when green was substituted for clear and it has been extended to the Kanawha & Michigan and the Kanawha & West Virginia within the last year. Since the system has been in effect very few lamps have been purchased for renewals. The repairs require only a small portion of one repair mechanic's time, there being about 2,000 switch lamps in service.

Below is a copy of the lamp instructions in force on the Toledo & Ohio Central and the Zanesville & Western. It is printed in large type on heavy paper and distributed to all lampmen and others interested and is expected to be nailed up on the wall for ready reference. Instructions on the Kanawha & Michigan and the Kanawha & West Virginia omit that portion relative to the oil distributing system, which has not as yet been extended to these roads.

OIL DISTRIBUTING SYSTEM

Long time burning oil for switch and signal lamps, etc., for the Toledo & Ohio Central and the Zanesville & Western is procured in tank car lots and distributed from the signal-telegraph department storehouse at Columbus. Upon the arrival of the car (ordered on specification) a test sample of oil is taken with a "thief" and a standard burning test is conducted on two standard lamps. If the oil meets the specifications, the tank is emptied by gravity into supply tanks, from which it is measured out into 52-gal. shipping drums. The arrangement of drum and drum stand in use by each lampman and section foreman and the funnel and curved spout, filling can, etc., are illustrated in one of the photos.

It will be noted that the shipping drum is also used by the lampman as a storage tank without emptying or transferring the oil, thus avoiding the extra investment and expense and the hazard of contamination. The lampman anticipates his needs 30 days in advance of the date he will be out of oil by requisition on a special blank, provided for the purpose. The new supply drum is then

timed to reach him by the time his supply is exhausted, thus causing minimum delay in returning the empty drum and requiring the minimum number of drums in the rotating supply. Not less than a full drum is shipped to any lampman. In some cases such drums will last three months and in others only 15 days.

Drums are handled by local freight in oil cars along with other oil carried as revenue freight. It was necessary in a few places to make special arrangements in order to unload the drums at the lampman's headquarters, where such headquarters were not immediately adjacent



Lampman Filling Can From Oil Storage Drum

to a station. Each drum carries its serial number and a metallic plate of instructions as to use, also shipping directions.

This system requires the time of a helper one-half day twice each month to supply the Toledo & Ohio Central and the Zanesville & Western with long-time burning oil for the use of switch and signal lamps. The supply is also used for kerosene motor cars, for adjacent stations where oil lights are used, and for kerosene lanterns used by the track and signal departments.

ON LOOK-OUT FOR PILFERAGE

T. H. BEACOM, vice-president and general manager of the Chicago, Rock Island & Pacific, has issued some interesting circulars designed to enlist the co-operation of all employees in campaigns to reduce loss and damage to freight. Members of the maintenance of way department are called into this work as outlined below:

Division engineers have been instructed to pay special attention to the condition of all buildings through which "freight, baggage, mail and express" is moved. The purpose of this work is to keep at a minimum all loss and damage claims resulting from pilferage and injury while freight is being handled in these structures. Hand in hand with the work of the division engineers in checking up the condition of buildings, are the functions of the master carpenters who are to assist in cutting down losses from pilferage and damage by making prompt repairs to railroad structures.

Roadmasters, during normal routine periods, are to observe, and where necessary correct, methods of handling freight in and around stations. In case of accidents, however, they are to supervise the collection of damaged freight and are to provide police protection adequate to prevent thievery while the freight is being gathered and checked.

Bridge and building foremen, like master carpenters, are to take steps to prevent damage to buildings housing freight, and to make necessary repairs to these structures promptly and thoroughly.

WELL INSPECTION, TESTING AND WATER EXAMINATION

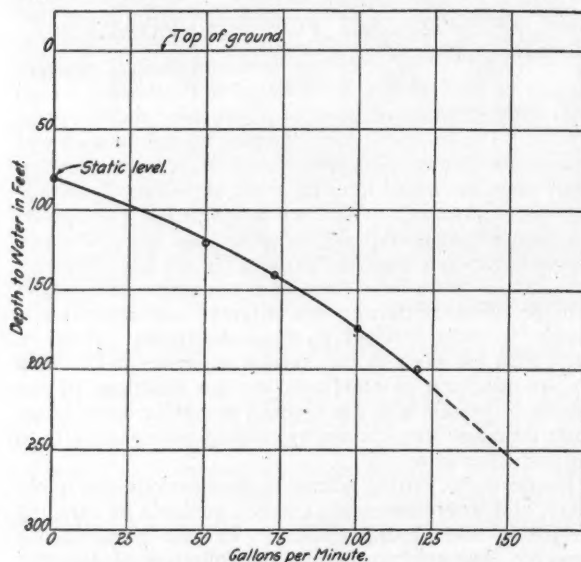
By FRED D. YEATON

Assistant Engineer, C. M. & St. P., Chicago.

THE INSPECTION of well drilling, the testing of the quantity of water available and the chemical and bacteriological analyses of well waters have not been given the consideration their importance justifies. Many municipalities and railroads leave the matter of inspection and testing to the well driller and depend upon the state or federal authorities to determine the quality of the water. Such a policy may be the only feasible one in some instances, but when at all possible to carry out there is usually an advantage to be gained in maintaining a close supervision over the drilling and definitely providing for the testing of the waters.

The inadvisability of allowing work to be done without an inspector present is illustrated by the following instance: A contract was awarded to a driller for a well 50 ft. or more in depth at a location where it was expected that water would be obtained 50 ft. below the surface. A well was drilled 500 ft. deep and a report was made stating that it was impossible to get water above that level. Several years later another well driller obtained a large supply of water near the first well at a depth of only 60 ft., indicating that the first driller had passed through the water bearing stratum. In another instance, several wells were drilled to a depth of 150 ft. and a report was made that no water was found. Later the driller made a proposition that he could find water by drilling another well and was willing to take the contract on the basis of "no water, no pay." The suspicions of the interested parties having been aroused, another driller was employed with the result that a large quantity of water was found at the 150-ft. level.

Previous to drilling, the inspector should make a careful study of all adjacent wells, obtaining logs of the wells and all available analyses of the waters. Such a site should be chosen for the well as will avoid sources that might cause contamination, such as cinder beds, cesspools



Typical Graph of a Well Test

and stockyards. The well should be located far enough from buildings and other obstructions so that its location will always be desirable. The inspector should examine the well casing, couplings, and strainer to detect possible defects and as the drilling proceeds should keep an ac-

curate log of the well, so that the depth and character of the water-bearing formations may be known. All water-bearing strata should be examined as to their thickness and tests made of the quality and probable quantity of water in each. The static head of the water in each water-bearing stratum should also be determined. For the purpose of examination it is, of course, essential that each stratum be separated from the others, an undertaking which requires proper arrangement of the casing, packers and plugs. If an undesirable stratum is then found, the water from it can be excluded by casing it off.

It has been considered the duty of the driller to test the capacity of the well, but unless the tests are directed by surface of the ground for each rate of pumping should be obtained. By plotting the data thus acquired in the form of improper pumping machinery. Good practice requires the testing of the well for at least three different rates of pumping. The static level of the water should be determined and the distance that the water stands below the an engineer, the results may lead to the installation of shown on the accompanying chart, a good basis is thus provided for determining the depth below the ground at which the water cylinder should be placed and the quantity of water that can be obtained at any rate.

The well should be pumped until the fine sand is removed, slowly at first to avoid excessive strains on the well and the speed gradually increased. The length of time for each test depends upon the water-bearing strata. If the water comes from a shallow well or a gravel vein of doubtful character, it is advisable to run the tests for a longer period than if the water came from a well-known artesian basin. Careful testing of all wells will pay.

The extent of the examination made for quality may vary from a visual examination of the water to a complete analysis, depending upon the use for which the water is intended. If the water is for steam purposes samples should be obtained for chemical analyses. It is best to obtain these samples at the end of each pumping test, because the water is usually more representative at that time.

One gallon glass-stoppered bottles are satisfactory for sampling. They should be cleaned carefully and their stoppers tied down with cloth. After a bottle is thoroughly rinsed with the water to be sampled, it should then be emptied and the sample collected. The bottle should be filled excepting for a small space provided for possible expansion. This sample, together with a complete description of the well, date the sample was taken and temperatures of both the air and the water should be furnished the chemist. A rough sketch of the surroundings of the well, showing distances to houses, barns and other objects that might affect the quality of the water, is valuable information to send with the sample. It is best for one never to pass judgment upon a water, the history of which is not thoroughly known.

In water supply work it is convenient to have the water analyses reported in grains per U. S. gallon, but if the analyses are expressed in parts per million, conversion from the first form to the other can be made by employing the factor 17, parts per million divided by 17, giving grains per gallon. Analyses given to the nearest grain per gallon are usually sufficiently close for ordinary work.

The responsibility for furnishing water safe for drinking purposes is an increasingly important one on railroads. If water from a well or any other source is to be used for drinking purposes, a bacteriological examination of the water itself together with a sanitary survey should be made. By means of these a thorough knowledge of the purity of the water, the source of supply and the opportunities for pollution is obtainable.

HOW TO SUPERELEVATE TRACKS ON BRIDGES

Methods in Common Use Vary in Relation to Economy,
Effectiveness and Security

THE superlevation of curved track on a bridge may be accomplished in a number of ways. Most of these methods are well known to practical bridge men, but their relative merits, particularly as to cost of installation, the ease of maintenance, security, etc., have not been discussed to any considerable extent in recent years. Believing that a review of this detail of bridge practice will be of interest to the readers of the *Railway Maintenance Engineer*, we present four discussions of this subject by men who have devoted their lives to railway bridge work and who are, therefore, conversant with this subject in every detail.

AVOID EXCESSIVE DAPPING OF THE TIES

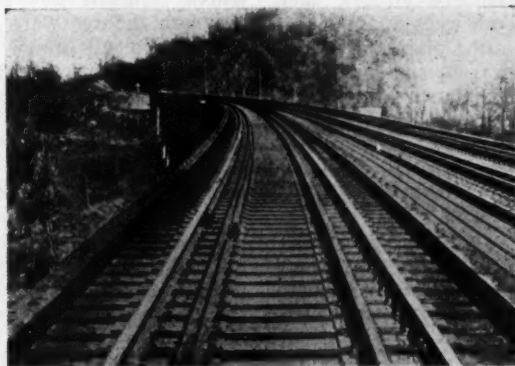
By R. H. REID,

Supervisor of Bridges, New York Central Lines West of Buffalo, Cleveland, Ohio.

IN FRAMING ties for bridges it is generally considered desirable to make the daps not less than one inch deep to hold the ties securely in place, nor more than one inch deep to avoid the tendency of the ties to split or break where the daps are framed too deep. To keep within these limits in providing superlevation of the track on steel bridges requires some ingenuity, but it may be accomplished in a number of ways as shown in the drawing where eight methods of obtaining superlevation have been indicated for a case requiring approximately five inches of superlevation of the rail. The same methods, however, would apply with more or less superlevation or for bridges of other proportions than those shown in the sketches.

The length and type of the bridge influence to some extent the most desirable method of providing superlevation. For instance, a short span of I-beam girders with proper lateral bracing and vertical diaphragms, can, in most cases, be placed on wedge-shaped pedestals, as shown in Fig. 1, so that the webs of the I-beams will stand normal to the plane of superlevation, permitting the use of standard ties, framed as for ordinary track on tangent. These I-beam girder spans can be placed, if desirable, on abutments or piers built with the bridge seat course finished at the same inclination as the superlevation, as shown by the dotted line at the base of the I-beams, and avoid the use of pedestals. However, if it becomes necessary to line the track over, it can be done more easily if the I-beams are set on wedge-shaped pedestals on a level bridge seat, than if the bridge seat is inclined to the superlevation of the track, as any change in alinement on such a bridge seat would necessarily require a change in the grade of the track.

Another method in quite general use, shown in Fig. 2, is to place longitudinal shims on the flange of the girder under the high side of the track. Shims for this purpose should, of course, be of hard wood, and should be fastened firmly to the flange of the girder, so they cannot move sidewise, and also be bored for the rivet heads



in the girder flange, if there are any rivets. A good way to fasten these shims to the girder flange, is to put coach screws or lag screws up through the girder flange, and into the shim. These shims can, if desirable, have their upper surface framed parallel with the plane of superlevation, so that the ties over the shim can be framed with a standard dap. One disadvantage of this method is that frequently these longitudinal shims do not last as long as

the ties, making it necessary to renew the shims before the ties would need renewing, and as the shims are generally in lengths of from 12 to 16 ft., it is not easy to replace them under traffic on account of the need of handling so many ties. It is also not easy to change the superlevation with shims of this kind, while keeping the track in continuous service.

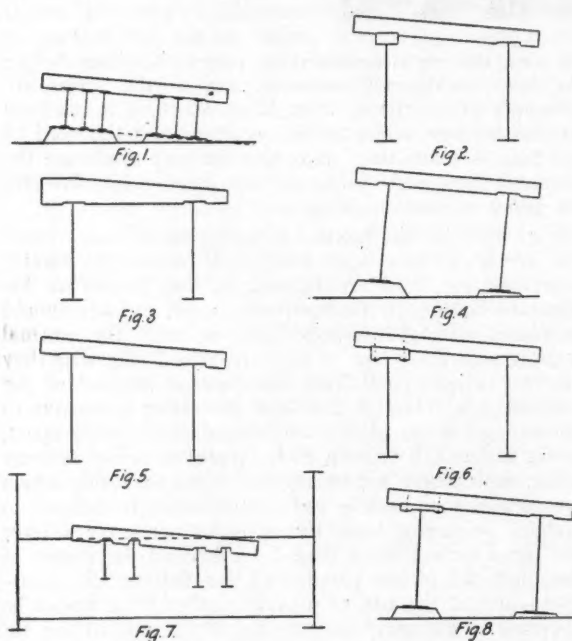
Fig. 3 shows the method of using taper ties. These ties are sewed to a taper which will furnish the correct superlevation, and are framed on the bottom as for standard track. If this method is used, the ties should be placed with the beveled side up and the normal straight side down, for, if they are placed otherwise they are apt to split back from the daps on account of the diagonal cut. Ties of this kind are rather expensive to obtain, and if the girders are spaced very widely apart, as for instance, 8 or even 10 ft., center to center in some cases, with heavy superlevation, it requires ties which are unwieldy to handle and correspondingly difficult to obtain. In sawing these ties, it is not necessary to have the bevel extend more than 6 in. beyond the center of the high rail of the curve, and this feature will sometimes permit the use of smaller timber than would be the case if the bevel was carried to the end of the tie.

Another method, shown in Fig. 4, is to tilt the girder spans so the flanges will be parallel with the plane of superlevation, resting them on wedge-shaped pedestals similar to the method shown in Fig. 1. If this is done care should be taken to insure that the lateral and vertical bracings are designed to take care of the stresses which will result from trains moving at different speeds with the girders in the inclined position. Among the advantages claimed for this method is the normal framing for the ties, and also that the position of the girder enables it to withstand more readily the centrifugal force of the moving train. However, in case of single track on a heavy grade, which is a quite common occurrence, the trains moving up hill over the structure, and ordinarily moving very slowly, will cause considerable lateral stresses in the structure, unless the lateral and diagonal bracing are designed to take care of trains at slow as well as rapid speed. In case of double-track or four-track road, where the movement over each track is always the same, the superlevation and other features in the structure can be designed for the speeds at which trains run on those tracks, and the arrangement is quite satisfactory.

Another method, shown in Fig. 5, provides for the superlevation by using a deeper girder under the high

rail, permitting the use of standard ties with reasonable dapping over the flanges. This arrangement is rather expensive in installation, on account of the greater cost of designing and building girder spans of this type, as it will ordinarily require a separate shop plan for each web of the girder, and special designing for the lateral and vertical bracing, while in standard girders, shop plans are generally made so that both webs of the girder span can be fabricated from the same plan, and lateral and vertical bracing are designed from standard practice. The renewal of ties, however, on a structure of this type, is comparatively inexpensive; probably ranking next in economy to Fig. 4.

Another method, shown in Fig. 6, provides for super-elevation by using a short corbel on the under side of the tie. This corbel should be framed $\frac{1}{8}$ in. into the under side of the tie, to prevent longitudinal movement, and the combined piece framed for the proper super-elevation. The corbel should also be fastened to the tie with coach screws, or lag screws, as they are sometimes called,



Typical Methods for Providing Super-elevation

to prevent it from working loose. The corbels need be only long enough to provide shoulders at each side of the girder flange, wide enough to prevent splitting out, and also to permit the use of the coach screws for fastening the corbel to the tie. This permits the use of standard ties, and only requires short blocks for the corbels to take any amount of super-elevation, and is economical in material.

An arrangement sometimes used on truss or through girder bridges, having a floor system, and where the stringers are riveted into the floor beams, is shown in Fig. 7. The stringer under the outer rail is set enough higher than the stringer under the low rail to furnish the required super-elevation. This method can be used either with single stringers or with double stringers, as shown in the sketch. Consideration must be given to the arrangement so the stringers can be riveted into the web of the floor beams without the top of the high stringers projecting above the top of the floor beam, and also the low stringers, so arranged that the top of the tie *under the rail* will be far enough above the top of the floor beams to prevent the rail riding the floor beam. This, however,

is a matter of design, and does not affect the principle.

Several combinations of these methods have been used from time to time, such as the combination of No. 2 and No. 5, also of No. 5 and No. 6, and of No. 4 and No. 6.

In regard to the relative merits of the various plans, No. 6 is probably the best for ordinary construction where standard girder spans or stringers are used; although the renewal of ties on No. 6 will cost more than on No. 4. In new construction, especially on girder spans of ordinary size, the method shown in No. 4, can probably be used very satisfactorily, and the ties on those girders can probably be renewed cheaper than by any of the other methods shown. Ordinarily one of the methods shown on the diagrams will take care of any reasonable super-elevation, but if one wishes to go to the expense of very fine work, probably a combination of No. 4 and No. 6 as shown in No. 8 will provide as nearly an ideal installation as any, by tilting the girder span up to such a degree as to take part of the super-elevation, and using corbels of sufficient thickness to provide the balance, especially on sharp curves of excessive super-elevation. This would permit the use of corbels of reasonable thickness, and also would take care of nearly all of the centrifugal force of the train without undue lateral stresses in the bracing of the girders. It is a refinement, however, not needed, except in special cases and on important railroad lines. There may be special cases for which some other method might perhaps be preferable, but those cases would have to be considered by themselves.

EACH METHOD HAS ITS PLACE

By F. E. SCHALL,

Bridge Engineer, Lehigh Valley, Bethlehem, Pa.

THE SUPERELEVATION of outer rails of railroad tracks on curves over open floor bridges may be accomplished by several methods. The general practice is to raise the outer rail to meet the requirements of the degree of curve and maximum speed of trains, operated over such curves. To raise the outer rails on open floor bridges, the following methods have been used:

(a) Using the regular bridge ties and bolting and spiking wedge shaped blocks to the underside of the ties, dapping the ties at the low rail and the bottom of the block at the high rail to suit the conformation of the supporting steel stringers or girders. (Fig. 6). When the blocks required figure less than $1\frac{1}{2}$ in. above the dap, the blocks should be set into the ties to obtain that thickness.

(b) Using beveled ties for bridge ties and dapping the bottom of the ties to meet the requirements of the supporting stringers or girders (Fig. 3).

(c) Designing the supporting steel stringers or girders with outside stringers or girders higher than the inside stringers or girders, and using ordinary bridge ties dapped to suit. (Fig. 5.)

(d) Designing the supporting steel stringers or girders of the same height and building the supporting masonry bridge seats to the incline required for the elevation of outer rails, or building the masonry seats level and supporting the steel stringers or girders on beveled bearing blocks with the outer blocks sufficiently higher to meet the required elevation of outer rail. (Fig. 1 and Fig. 4.)

(e) Placing wedge shaped blocks on top of the ties thoroughly spiked or bolted to the ties.

(f) Methods "a" and "b" (Fig. 6 and Fig. 3) are applicable to wooden trestles as well as to steel bridges. For pile trestles, the piles may be cut to the plane required for the elevation of outer rail; this will place the cap and the stringers on an inclined plane. On the

other hand, the piles may be cut to a horizontal plane and capped, placing a wedge-shaped sub-cap on top of the regular cap so that the stringers are inclined. In either case the regular bridge ties may be used. For frame trestles the same methods may be applied as described for pile trestles, except that the inclined plane should be provided for in the foundations, to facilitate the framing of the bents in which case all posts will be thrown out of plumb.

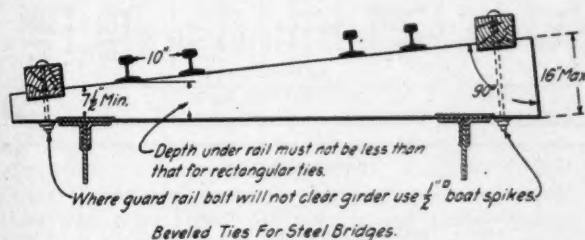
For steel open floor bridges, the method described in "a" should prove the most economical and entirely satisfactory. Method "b" should prove equally satisfactory, but will require an excess of timber. Methods "c" and "d" (Fig. 5, Fig. 1 and Fig. 4) are not considered good design or construction, and for through bridges may not be applicable, depending on the elevation of outer rail to be provided for. Methods "c" and "d" have the disadvantage that the elevation of outer rails is fixed and any variation, as for run-offs, must be made in the floor in any event.

RULES FOR SUPERELEVATING TIES

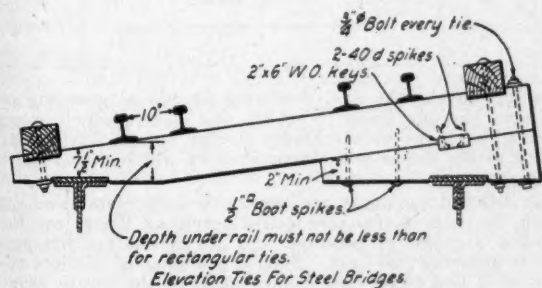
By G. W. ANDREWS

Assistant to Chief Engineer Maintenance, Baltimore & Ohio, Baltimore, Md.

THE SUPERELEVATION of rails on bridges on the Baltimore & Ohio when made with the ties is carried out either by beveling the ties or by the use of corbels or bolts. This matter has been given serious consideration for a number of years and as a consequence a definite set of rules has been drawn up, outlining exactly which method shall be used and just how it shall be carried out. These rules are illustrated in the drawing which is supplemented by the following instructions.



Beveled Ties For Steel Bridges.



B. & O. Superelevation Methods

The following table shows elevation ties of various depths. "Use beveled ties when the thick end does not exceed 16 in. Use a combination of rectangular ties and blocks when the thick end exceeds 16 in. The ties are laid with their ends parallel to the line of girders when the degree of curve does not exceed that given in table below for various lengths:

Bridges under 25 ft. long	about 10 deg.
25 ft. to 50 ft. long	about 6 deg.
50 ft. to 75 ft. long	about 4 deg.
75 ft. to 100 ft. long	about 3 deg.
100 ft. to 125 ft. long	about 2 deg.
125 ft. to 150 ft. long	about 1 deg.

"Ties are to be laid with ends parallel with the line of the track when the degree of curve is greater than that given in the table, in which case the ties are to be ordered sufficiently long to permit the ends to project at least 6 in. beyond the edges of the supporting girders, i. e., the length of the tie equals the distance out to out of supports plus the mid-ordinate of the curve plus 12 in."

The above information concerning ties for curve tracks must be supplemented by the following rules applying to rectangular ties on tangent track.

RECTANGULAR TIES.

Minimum dap $\frac{1}{2}$ in.

Maximum dap $1\frac{1}{4}$ in.

6 ft. 6 in. c. to c. size 8 in. by 9 in.
7 ft. 0 in. c. to c. size 8 in. by 10 in.
7 ft. 6 in. c. to c. size 8 in. by 11 in.
8 ft. 0 in. c. to c. size 8 in. by 12 in.
8 ft. 6 in. c. to c. size 8 in. by 13 in.
9 ft. 0 in. c. to c. size 8 in. by 14 in.
9 ft. 6 in. c. to c. size 8 in. by 15 in.
10 ft. 0 in. c. to c. size 8 in. by 16 in.
10 ft. 6 in. c. to c. size 8 in. by 16 in.

Length to be not less than the total distance over supports — 12 in. and to be ordered in even feet or half feet.

Use two depths of ties on girder spans where the thickness of cover plates is such that the maximum dap would be more than $1\frac{1}{4}$ in. if one size ties were used. Where two lines of rivets occur groove the ties to clear the rivet heads. Where four lines of rivets occur bore the ties for rivet heads.

THE USE OF BALLAST DECK SIMPLIFIES THE SUPERELEVATION PROBLEM

By A. F. ROBINSON

Bridge Engineer, Atchison, Topeka & Santa Fe System, Chicago.

ON THE Santa Fe the superelevation for open deck bridges has been made as a general rule in the pedestal stones, supporting the main girders. This applies both in deck and through spans, but for years past it has been the practice to apply ballast decks to all bridges on curves. With the ballast applied the superelevation of the outer rail can be made nicely, just as it is done on the road-bed.

There are now not more than about five or six spans on the entire system where the wedge-shaped ties are used; that is, where the depth of the tie at one end is made considerably less than the depth at the other to provide proper superelevation for the outer rail on the curve. These wedge shaped ties almost always give trouble in maintenance, even though they are properly cut to size and applied in the best possible manner. It almost always happens that these wedge ties will split down under service, especially toward the thin end of the stick. They must then be bolted up and are a source of considerable trouble and expense as long as the split or sheared member is left in the deck.

The method of making the superelevation by putting a longitudinal lift strip on top of stringers or girder under the tie is in my judgment very much to be preferred over the wedge shaped tie. This scheme, however, has its troubles. The elevating strips must be applied to the girders under both ends of the ties and these strips have to be cut in a special manner to provide for the superelevation. The framing and applying of lift strips of this kind are expensive and troublesome, but if they have been properly applied they will last a long time.

As previously noted, the superelevation for open deck spans on the Santa Fe is usually made in the pedestal stones. Since the same amount of superelevation will not be needed for curves of the same degree on different parts of the line this may cause some little trouble or confusion. Aside from this feature when they are properly put in the scheme works out very nicely indeed. Where it is possible to do so, I believe the only proper manner of providing the superelevation for the outer-rail is to put in a ballast deck.

RAILWAY EMPLOYEES ARE RECLASSIFIED

Labor Board Has Regrouped Maintenance Men Into Twenty-Seven Classes and Eighty Occupational Divisions

NEW RULES for the classification of railway employees and for the preparation of reports as to their number and compensation have just been issued by the United States Railroad Labor Board and approved by the Interstate Commerce Commission. The revised classification becomes effective on July 1 and reports on the new forms are to be made beginning with the month of July. The new classification and reporting instructions have been issued to the carriers in a volume entitled, "Rules for Reporting Information on Railway Employees, Together with a Classification and Index of Steam Railroad Occupations."

The employees in the maintenance of way department, who previously were divided roughly into eight classes, have been reclassified and grouped. Under the new arrangement maintenance of way and structures employees are divided into 27 reporting divisions. These divisions have in turn been further subdivided into approximately 80 occupational divisions.

The introductory statement in the volume issued to the carriers outlines very clearly the inadequacy of the present reporting plan, and after outlining the difficulties encountered by various wage commissions and arbi-

tration boards in collecting data upon which to base their decisions, the statement says: "In deciding the questions at issue, the Labor Board was seriously handicapped because of the absence of wage data relating to homogeneous groups of occupations and classified according to the special working conditions found in railway operation. It seemed evident that steps would have to be taken by the United States Railroad Labor Board to secure current and properly classified data if it were correctly to perform its functions according to the provisions of the law." The classification used for reporting the number of employees and their compensation is based largely upon a plan submitted to the Interstate Commerce Commission by the Railroad Administration during federal control. This classification was not adopted, but it was submitted by the Commission to representatives of the railroads and the employees.

and other data for homogeneous classes of railroad positions, to establish, as nearly as can be, a uniform terminology to be used in describing similar occupations, and to so classify positions that all railroads may have the same general understanding of the meaning of positions and report wage and compensation data upon a uniform and consistent plan.

The occupational classification is not considered by the Board, nor should it be considered by railroads or other interested parties as setting up jurisdictional lines for occupations or as limiting the kind of work which employees may perform, or the duties which they may assume. In preparing the classification the Board has not aimed to standardize for any railroad occupational duties assigned to, or the kinds of work performed by its employees and nothing in the classification could be construed in this light. Its purpose is solely so to group positions that the wage and other data reported by the railroads to the Interstate Commerce Commission and to the United States Railroad Labor Board may be used for administrative and public purposes.

The basis and general plan of the occupational classification conforms to the recognized lines and past practices which have been followed by industrial and governmental organizations in the development of employment classifications for their services, the entire plan being based upon the principle that duties and responsibilities must control in any orderly arrangement of positions. The occupational

TABLE I—FORM FOR REPORTING INFORMATION ON RAILROAD EMPLOYEES

Month of192..	Railroad.							
Division number	REPORTING DIVISION	Number of employees middle of month	Number of full time positions	SERVICE-HOURS (or days)					
				Straight time actually worked	Over-time paid for at pro rata rates	Over-time paid for at punitive rates	Time paid for but not worked	Total time paid for	
	1	2	3	4	5	6	7	8	
Division number	REPORTING DIVISION				COMPENSATION				
				Straight time paid for	Over-time paid for at pro rata rates	Over-time paid for at punitive rates	Time paid for but not worked	Total	Division number
				9	10	11	12	13	

tration boards in collecting data upon which to base their decisions, the statement says: "In deciding the questions at issue, the Labor Board was seriously handicapped because of the absence of wage data relating to homogeneous groups of occupations and classified according to the special working conditions found in railway operation. It seemed evident that steps would have to be taken by the United States Railroad Labor Board to secure current and properly classified data if it were correctly to perform its functions according to the provisions of the law." The classification used for reporting the number of employees and their compensation is based largely upon a plan submitted to the Interstate Commerce Commission by the Railroad Administration during federal control. This classification was not adopted, but it was submitted by the Commission to representatives of the railroads and the employees.

THE OCCUPATIONAL CLASSIFICATION OF EMPLOYEES

In describing the occupational classification of employees the Labor Board said:

The purpose of the occupational classification of railroad positions is to furnish a basis for the collection of wage

classification may be described as a functional grouping of positions, the aim being to set up unit classes which group together positions of essentially similar nature, having due regard to the duties and responsibilities which they require or imply.

All railroad positions are separated into main divisions which, for convenience, are called services. Those are the broadest divisions of positions and are determined irrespective of departmental lines. Such a grouping of services admits of a bird's-eye view being made of the entire range of railroad positions.

The services are sub-divided into groups of related positions covering work which is generally performed in the same profession, vocation or trade, or in a particular kind of railroad work. Wherever there are wide and clearly discernible differences in the importance, difficulty and responsibility of the work performed, the groups are further subdivided into grades which consist of one or more distinctive classes of positions. These classes are the smallest units provided for in the classification and are made up of positions carrying essentially similar duties and responsibilities. Each class is given a distinct title and described so far as is necessary to indicate the kinds of positions which fall under each distinctive class, having been set up according to the general railroad functions, as well as the special and peculiar requirements in railroad organizations. The services are sub-divided into 119 groups. Within the groups are

separate grades and distinctive class titles, each of which is provided with a description of duties generally performed and illustrative examples of payroll titles.

Outside of the executive, official and staff assistant service, which is ungraded and unclassified, and in which examples of positions are shown separately under appropriate groups but not distinguished as to importance and responsibility of the work performed, there are 500 distinctive classes distributed under the remaining 16 services.

The character of the data which are to be reported to the Interstate Commerce Commission and to the Railroad Labor Board under this new plan and the form upon which they are to be reported are shown in the accompanying Table I.

The reporting divisions into which employees in the maintenance of way and structures group have been divided are shown in Table II.

Some employees in the maintenance of way department will be reported in the "Professional, Clerical and General" group as shown in Table III.

Table II.

Reporting Divisions in Maintenance of Way and Structures Group.

III—Maintenance of Way and Structures

34	Road Masters and General Foremen (M. of W. & S.).....D
35	Assistant General Foremen (M. of W. & S.).....D
36	Supervising Maintenance of Way Inspectors and Scale Inspectors
37	Maintenance of Way Inspectors.....
38	Bridge and Building Gang Foremen (Skilled Labor, M. of W. & S.).....
39	Bridge and Building Carpenters.....
40	Bridge and Building Iron Workers.....
41	Bridge and Building Painters.....
42	Masons, Bricklayers, Plasterers and Plumbers.....
43	Skilled Trades Helpers (M. of W. & S.).....

44	Regular Apprentices (M. of W. & S.).....
45	Portable Steam Equipment Operators (M. of W. & S.).....
46	Portable Steam Equipment Operator Helpers (M. of W. & S.)
47	Pumping Equipment Operators (M. of W. & S.).....
48	Gang Foremen (Extra Gang and Work Train Laborers)
49	Gang Foremen (Bridge and Building, Signal and Telegraph Laborers)
50	Gang or Section Foremen.....
51	Laborers (Extra Gang and Work Train).....
52	Track and Roadway Section Laborers.....
53	Maintenance of Way Laborers (other than Track and Roadway) and Gardeners and Farmers.....
54	General Foremen and Supervising Inspectors (Signal, Telegraph and Electrical Transmission).....D
55	Assistant General Foremen (Signal, Telegraph and Electrical Transmission) and Signal and Telegraph Inspectors
56	Gang Foremen (Signal and Telegraph Skilled Trades Labor)
57	Signalmen and Signal Maintainers.....
58	Linemen and Groundmen.....
59	Assistant Signalmen and Assistant Signal Maintainers.....
60	Signalman and Signal Maintainer Helpers.....
	TOTAL (Maintenance of Way and Structures).....

Table III

Reporting Divisions for Other Maintenance of Way Department Employees.

II—Professional, Clerical and General

3	Architectural, Chemical and Engineering Assistants (A)
4	Architectural, Chemical and Engineering Assistants (B)
5	Sub-Professional Engineering and Laboratory Assistants
7	Supervisory or Chief Clerks (Major Departments)....
8	Chief Clerks (Minor Departments) and Assistant Chief Clerks and Supervising Cashiers.....
9	Clerks and Clerical Specialists (A).....
10	Clerks (B)
11	Clerks (C)

Labor Board Clears Up Points of Controversy

SEVERAL hearings and decisions of significance to executives and employees in the maintenance of way department have marked the past month's proceedings before the Railroad Labor Board. Immediately following the announcement of the wage cut on June 1, announced in the June issue of the *Railway Maintenance Engineer*, representatives of various railroads appeared before the Board asking that the rates of pay in effect prior to the wage increase of last July be restored, despite the decision of the Board which had just been handed down. These hearings were, in reality, a continuation of the wage reduction hearings which ended in the ruling of June 1 and were held in order to receive arguments from those roads which were not able to properly certify disputes to the Board in time for inclusion in that ruling.

These hearings were closed on June 9, but the Labor Board did not announce its decision until June 27 under the designation "Addendum No. 1 to Decision No. 147," which covered the applications of 79 roads for reductions in wages, including those who were not included in any way in Decision No. 147 and a number of roads which had made further application for reductions on certain classes of employees which they had failed to include in their original applications. The effect of the addendum is to establish complete uniformity in the reductions of wages as for all classes of employees and all roads involved. The text of the ruling of the Board is as follows:

"The labor board therefore decides that Decision No. 147 shall apply to the carriers hereafter named and to the special classes of employees named or referred to under each of said carriers with the same force and effect as if said carriers and employees had been named originally in said decision."

As we go to press the Labor Board has continued the national agreements in effect after July 1 until such time as it shall be able to reach a decision concerning the same. Pending this decision the Board has instructed the roads to pay only straight time for all overtime worked, but they are required to keep an accurate account of the difference between the amounts actually paid and the amounts that would have been paid with punitive overtime rates so that this could be paid to the men later in case the Board decides to retain punitive overtime in the agreements. The Board specifically states that this action should not be considered in any way as forecasting the character of its decision in this regard.

A ruling made by the Board in a controversy over the negotiation of agreements is also of particular interest. A dispute arose between several of the larger carriers, including the Chicago, Burlington & Quincy, the Chicago & Eastern Illinois and the Texas & Pacific, and their shop employees as to whether an agreement should be made, in accordance with the Labor Board's Decision No. 119, with each of the six shop crafts or with the Railway Employees' Department of the American Federation of Labor as representing all six crafts. The Board decided that an agreement should be made with the Federated Shop Crafts, provided that organization represented a majority of each craft or class. In the case of the Chicago, Burlington & Quincy the following provision was appended: "This decision shall not operate to prevent the negotiation of such special rules for employees represented in other departments as are necessary."

The controversy between the Chicago & Eastern Illinois and the federated shop crafts was of a slightly dif-

ferent nature, although the decision of the Board was in general the same. The dispute in this case was whether or not the Federated Shop Crafts have the right under Decision No. 119 to insist upon one agreement to cover the employees whom they represent in the maintenance of equipment, maintenance of way and structures and maintenance of signals and telegraph departments. The carrier insisted upon separate agreements for each of these departments, whereas the employees insisted upon one agreement covering its members in all of the departments.

The Labor Board ruled that "the agreements between the federated shop crafts and the carriers shall, if said federation so elects, refer and apply to all employees comprised in said class or crafts employed in the maintenance of way department and the signal and telegraph department; provided this decision shall not operate to prevent the negotiation of such special rules for said maintenance of way and signal and telegraph departments as are necessary for the economical operation of said departments and are peculiarly applicable to the nature of the work and the conditions surrounding it in said departments as distinguished from the more highly specialized work of the maintenance of equipment department."

Another decision of importance handed down by the board is that in the controversy between the Missouri, Kansas & Texas and the Brotherhood of Railway and Steamship Clerks, Freight Handlers, Express and Station Employees. The dispute in this case was whether or not an agreement covering rules and working conditions of the employees of a carrier be made directly with the employees or with an organization representing the employees. The Labor Board rules that the organization, under the provisions of Decision No. 119, has the right to make an agreement as to rules and working conditions for the entire class of employees, both non-members and members of the organization.

SECTION FOREMAN HELD RESPONSIBLE FOR BAD WRECK

THE Bureau of Safety of the Interstate Commerce Commission has investigated a collision which occurred on the Norfolk & Western near Welch, W. Va., on May 3, 1921, and which resulted in the death of six passengers and the injury of 42, and finds the cause of the accident to have been an open switch, for which the section foreman is blamed. The collision occurred when the passenger train, moving backward as it was accustomed to do over this section of track, entered a siding through the open switch and struck a cut of loaded coal cars before it could be stopped. At the time of the accident section men were working a short distance from the switch, while the foreman was within 600 ft.

The investigation developed that the foreman had been operating a motor car through the switch and had depended on one of the section men to look after it. Although the section man claimed to have inspected the switch point before leaving the switch, examination plainly showed it to have been set for the siding. The switch lock was in position, but not locked. The fact that the section foreman had depended upon one of his men to handle the switch was pointed out to have been a cause for blame in itself, inasmuch as rule 617 of the operating department reads in part as follows: "They (section foremen) must not permit their switch keys to pass out of their possession, and must personally attend and supervise the opening and closing of switches."

REMARKABLE RESULTS FROM TIE TREATING

A MOST interesting and convincing proof of the possibilities in wood preservation as applied to ties and particularly ties made from what are commonly considered as inferior woods, is furnished in the record of tie treatment on the Chicago, Indianapolis & Louisville. Inaugurating a program of tie preservation as early as 1907 and consistently adhering to and developing it in the years following, this road is now operating over tracks in which practically all of the ties are treated. The practical results of this program are well reflected in the reduction which has been effected in the annual tie consumption.

Prior to treatment the approximate number of ties required annually was 302,000. At the present time this figure has fallen to 125,000, while the normal consumption is not expected to exceed 175,000. This represents a reduction of more than 40 per cent, a figure which is all the more interesting when it is considered that 90 per cent of the ties are red oak and beech of Indiana growth. These woods have long been considered inferior for use as ties. The experience of the Chicago, Indianapolis & Louisville, however, has shown that while this is true for the untreated wood, excellent results can be obtained through proper treatment.

Constituting an even more forceful evidence of the truth of this, together with a particularly interesting record of the effect of tie treatment in other respects, are the results obtained from a section of test track north of La Fayette, Ind. This section, which is still under test, comprises eight-tenths of a mile of tangent track laid with 90-lb. rail in gravel ballast, tie plated with Economy plates and carrying 5,500,000 tons of freight annually. In 1914, 1,327 ties of different species were placed in this track, all of which were treated with creosote according to the Lowry process. Inspected in September, 1920, it was found that without exception all of these ties, including 793 of red oak and beech, were still in good shape. The several species and the number of each used are as follows:

White oak, hewed.....	131	Black pine, hewed.....	196
Red oak, sawed.....	199	Black walnut, hewed....	4
Red oak, hewed.....	198	Cherry, hewed.....	6
Beech, hewed.....	198	Sassafras, hewed.....	15
Beech, sawed.....	198	Mulberry, hewed.....	2
Elm, hewed and sawed..	200		

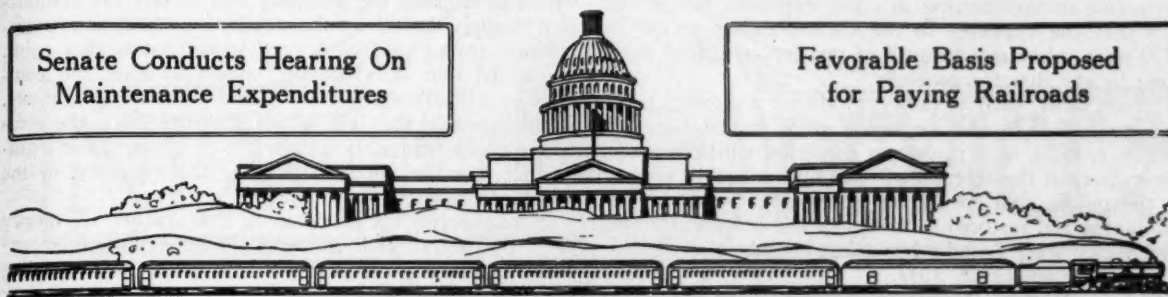
The experience of the C. I. & L. with respect to white oak ties is another item that merits special attention. It will be noted that 131 white oak ties were included in the series of treated ties originally placed in the test track. At that time, however, and until a few years ago, it had not been the practice of this road to treat white oak ties, in this respect adhering to the general opinion that white oak ties were sufficiently resistant to rotting as not to require treatment. It was observed two or three years ago, however, that where treated ties of other species were in good condition untreated white oak ties placed in the track at approximately the same time invariably showed distinct signs of decay. This observation, together with the results obtained by treatment, have induced the C. I. & L. to treat white oak ties as well as those of other species. All tie preservation for the road is performed by the American Creosoting Company at Bloomington, Ind.

ON-TIME RECORD.—The through freight trains of the Pennsylvania arrived at destination on time, in April, in 79 per cent of the trips. This is the first month for which complete figures of performance are available, and is the record for this road.

RAILWAY AFFAIRS AT THE NATION'S CAPITAL

Senate Conducts Hearing On
Maintenance Expenditures

Favorable Basis Proposed
for Paying Railroads



Washington, D. C.

TENTATIVE principles which the Bureau of Finance of the Interstate Commerce Commission proposes to use in discussions with the railroads as to the amounts to be allowed for maintenance expenditures in calculating the railroad guaranty for the six months' period following the termination of federal control were outlined in an address at the recent annual meeting of the Association of Railway Accounting Officers by W. A. Colston, director of the bureau. While they have not been approved by the commission, these tentative principles support many of the contentions advanced by the railroads and are contrary to the position taken by the Railroad Administration in its controversy with the railroads on the same subject as affecting the settlements for the 26 months of federal control.

The Transportation act, in providing that there should be charged for maintenance for the purpose of ascertaining the guaranty no more than an amount to be fixed by the commission, set up as the rule to guide the commission the provisions of the standard contracts governing the obligation of the director general to maintain the railroads during federal control. While the Railroad Administration has been insisting that its obligation was met if it spent a given sum of money, according to its formula, the railroads are filing claims for under-maintenance based on a physical test.

Director Colston takes the position that the law provides no substitution of anything for the physical test, and the first of the principles he outlined was that "the Bureau of Finance will, so far as practicable, under the accounting test established by the proviso of Section 5 of the standard contract, fix such amounts as would have resulted during the guaranty period in the same amount, character and durability of physical reparation as was applied to the respective carrier properties during an average six months of the test period, three years ending June 30, 1917, making due allowance for difference in the amount and use of the properties involved." Another of the principles tentatively adopted by the bureau recognizes the claim of the railroads that allowance should be made for inefficiency of labor and, as stated by Director Colston, "in making the adjustments for changes in cost of labor, consideration will be given to all changes of any character which affect in any way the labor cost of material in place and will include not only changes in price of labor per pay roll hour or other unit paid for, but also the relation of time paid for to effective time of work, differences in the efficiency and cost of labor, due to changed personnel, and any other elements affecting the aggregate cost of labor necessary to effect the standard of maintenance observed by the carriers respectively during the test period."

Mr. Colston said that "unless we do something we will crucify the carriers on the cross of inaction," and while he said he had not yet been able to get a decision on the most important or troublesome factor affecting

the settlement of the accounts—the matter of maintenance—and he did not believe a general ruling could be obtained in the near future, he had been authorized to put a specific case or cases up to the commission, and he invited the carriers to submit their claims for discussion across the table in accordance with the principles he had outlined without waiting for a final determination affecting all the carriers.

In his testimony before the Senate Committee on Interstate Commerce, President Rea of the Pennsylvania had urged some plan for expediting the settlement of the accounts between the railroads and the government, and it is understood the whole subject has been given attention by the President and his cabinet, but one difficulty in the way is the reluctance to ask Congress for a large appropriation to pay the bill, even if a more liberal policy toward the railroads could be agreed upon.

MAINTENANCE EXPENDITURES DISCUSSED AT SENATE HEARING

The question of maintenance expenditures has occupied a prominent place in the hearings before the Senate committee in its general inquiry into the railroad situation. The railroad testimony before the committee was concluded on June 17, but the hearings were expected to continue for several weeks longer to hear from shippers, labor leaders and others.

The necessity for making up for the lack of adequate maintenance during the period of federal control in order to restore the railroads of the country to a condition to meet increased transportation demands was responsible for a large part of the increase in the cost of railroad operations in 1920. L. E. Wettling, manager of the statistical bureau of the western lines, testified.

Chairman Cummins called attention to the fact that this increase in the cost of maintenance was particularly marked during the six months' guaranty period, and, in reply to his question, the witness explained that it was necessary to make extraordinary expenditures for maintenance immediately after the termination of federal control.

GUARANTY DOES NOT COVER ANY EXCESSIVE MAINTENANCE

"It has been alleged," said Senator Cummins, "that the railroads were reckless during the guaranty period because the government in any event must make good the amount from the federal treasury. I want it to be especially emphasized that the Transportation act guarded completely against any such contingency as that, and if it turns out that the railroads have expended more from March 1 to September 1, 1920, than they ought to have spent according to a formula which was adopted under the standard contract, then the government is not required and will not be required to pay anything because of that fact."

"One of the controlling factors," said Mr. Wettling, "which tends to distort comparisons and makes the in-

crease in these expenses in the 1920 period seem disproportionate to the increase in other expenses, lies in the fact that the expenses in the corresponding period in 1919 were subnormal because of restrictions placed upon them by the director general.

"Necessarily such a policy produced a condition of undermaintenance and the roads were turned back on March 1, 1920, in a run-down condition which made it imperative, in the interest of safe and adequate service to the public, that so far as possible the roads be rehabilitated and restored to the condition and efficiency in which they were found when taken over by the government on December 28, 1917.

"The costs were abnormally increased over the corresponding period of 1919 by several well-known factors, the principal items being the labor award of July 20. This large increase affected the costs materially during four months of the period under consideration and the cost was also greatly increased, during the entire six months, by reason of the so-called national agreements, none of which were in effect during the corresponding period of 1919; another large factor entering into the increased cost of maintenance was the increase in prices of material, which in May, 1920, were more than 20 per cent greater than in May, 1919, and continued to increase, reaching their maximum in July and August, the average for the year being estimated at about 30 per cent over the average price for 1919.

"The fact that the natural tendency was to limit these maintenance expenses to what were absolute necessities should be evident when consideration is given to Section 209 of Transportation act, 1920, which definitely fixed a limit on the amounts to be allowed for such expenditures and constituted public notice to the carriers that any expenditures in excess of such limits would have to be borne by the carriers themselves.

"Nevertheless, because of the urgent necessities therefor the carriers continued their program of restoration of the properties until in October, 1920, when it became apparent that a general business depression was imminent and that the full net revenues anticipated as a result of the advances granted in Ex Parte 74 were not being realized. Most of the roads had little hope of further advances from the Railroad Administration, and because of the refusal of the Secretary of the Treasury to honor certificates of partial payment for the guaranty period the carriers found themselves short of funds and were thus manifestly unable to continue the necessary maintenance expenditures, and the expenditures since November, 1920, have suffered a substantial reduction below the necessary requirements by many roads."

Senator Cummins had called attention to an exhibit filed by Mr. Wettling, saying that the increase in expenses for maintenance of way and structures during the guaranty period as compared with the corresponding period of 1919 of 45.4 per cent, and in maintenance of equipment expenditures of 39.2 per cent as compared with increases of only 15.1 per cent and 10.9 per cent, respectively, in the six months ended with February, 1921, arrested attention. Alfred P. Thom, counsel for the railway executives, replied that for that reason he desired to call attention to the fact that under the terms of the law the railroads are not protected by the guaranty for the entire amount of the maintenance expenditures during this period, but only to the extent of the amount to be determined by the commission. The railroads made this necessary increase in expenses with their eyes open, he said, because the expenditures had to be made to put the properties in condition to handle the traffic. Senator Cummins said it would be well at that point to read

into the record the provision of the Transportation act which thus limits the guaranty and directs the commission to apply the rule of the standard contract as to maintenance, saying that he desired to emphasize that point. He added that it is not yet known whether the commission will allow the full amount of the expenditures. Mr. Thom said that it is known, however, that the commission will reduce the amount to be charged for maintenance, for the purpose of fixing the guaranty, to the standard provided for in the act.

In explaining the increase in the amount of money spent by the railroads during 1920 for maintenance purposes compared with the previous year, Mr. Wettling said the railroads performed more maintenance work during the past year than in either 1918 or 1919, when they were under federal control. Although the cost was much greater, owing to the increased cost of labor and materials, he said they performed less, however, in 1920 than they averaged annually during the test period, which consists of the fiscal years of 1915, 1916 and 1917. Mr. Wettling said the increase in the amount expended for maintenance purposes in 1920 over 1919 "was not abnormal or excessive."

Reports from 93 per cent of the Class I railroads, representing approximately 218,000 miles, show that in 1920 they spent \$961,304,000 for maintenance of way and structures, compared with \$727,705,000 in 1919 and \$616,742,000 in 1918, while during the test period they averaged \$383,699,000.

In 1920, those roads laid 2,262,033 tons of new and second-hand rails, the total cost of which was \$82,219,999, compared with 2,027,159 tons costing \$69,961,049 in 1919 and 1,615,963 tons costing \$50,836,964 in 1918. During the test period the yearly average was 2,041,676, while the total cost was \$54,166,631.

The ties placed during those years follow:

	Average per annum Test Period	1918	1919	1920
Switch ties (feet).....	172,689,571	160,024,789	176,079,389	170,345,388
Bridge ties (feet).....	55,625,964	45,400,555	49,644,851	41,533,926
Other ties (number)....	88,885,109	69,327,243	78,398,922	77,015,580
Total cost	\$58,135,355	\$62,886,865	\$84,156,035	\$107,772,885

Taking up the question of ballast, Mr. Wettling said those roads in 1920 applied 19,118,553 yards at a cost of \$12,045,000, or an average cost of 63 cents per yard. In 1919 those roads applied 17,518,791 yards at a cost of \$9,481,545, or an average cost of 54 cents, while in 1918 they applied only 14,796,252 at a total cost of \$6,472,151, or an average cost of 43.7 cents per yard.

Of the total cost of maintenance of way and structures, \$577,688,000, or 60.09 per cent, was paid to labor. Cost of material was 29.67 per cent. During the test period \$209,906,000, or 54.71 per cent, went to labor; \$401,331,000, or 65 per cent, in 1918, and \$439,140,000, or 60.35 per cent, in 1919.

In connection with a table comparing the operating accounts from 1912 to 1920, Senator Cummins said that the public is being misled by the repeated publication of figures showing the net operating income earned in 1918 and 1919 during the period of federal control, because people were led to believe that the government's loss from the operation of the railroads was only the difference between the amount actually earned and the guaranty to the railroads. If the government had properly maintained the properties, he said, the net operating income would have been smaller and the loss to the government would have appeared larger, and he estimated that the government's loss after allowing for undermaintenance claims would be at least a billion and a half instead of seven hundred, eight hundred or nine hundred million dollars.

NEW DEVICES

A RECENT DEVELOPMENT IN AIR HOSE

THE Chicago Pneumatic Tool Company, New York, has recently increased its supply of air tools and equipment applicable to and accessible for use on railroads by adopting a new type of air hose. Of the several brands and styles which this company now carries, the hose, called the Chicago Pneumatic cord air hose, is considered to be its best. The hose consists essentially of a flexible tube of firmly braided cord, lined and covered



Chicago Pneumatic Cord Air Hose

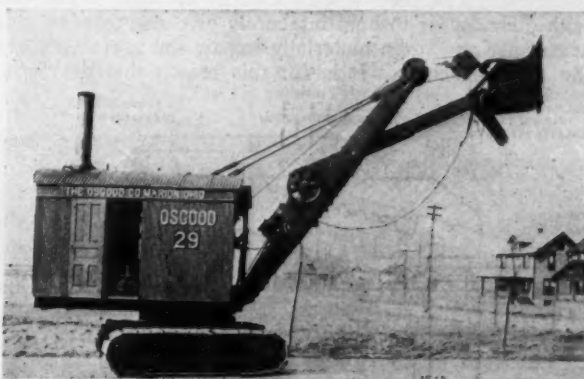
with thick rubber prepared specially for the purpose. It is said that the interior tubing is immune to the action of oil, one of the chief forces of deterioration which air hose is required to withstand, and that the elasticity of the hose and its resistance to surface wearing, to stretching, peeling, kinking or collapsing are such as to make the application of wired winding unnecessary. The hose is made only in $\frac{1}{2}$ and $\frac{3}{4}$ -in. sizes and is furnished in 25 or 50-ft. lengths. It is tested for 350 lb. internal pressure.

A CATERPILLAR-MOUNTED STEAM SHOVEL

THE practice on some roads for maintenance forces to undertake earth or other material handling work of a nature or on such a scale as to make desirable the use of power machinery has established a condition where the attention of railway officers may well be directed to steam shovels and similar equipment which has been adapted to ground operation. Where excavating, stripping or transference work is carried on at a distance from the tracks or under conditions where the laying of temporary tracks for the support of such machines is not feasible, equipment of this kind may often provide a satisfactory solution of the problem.

In this respect it is of interest to note that the Osgood Company has developed a continuous tread mounting for its No. 29 revolving steam shovel. This shovel is a one-yard machine originally designed for use in railway ditching service and is equipped with a steel boom, extra drums and other auxiliary apparatus for its conversion into a crane, clam shell or drag line outfit. The caterpillar mounting developed for it is a substantial piece of construction comprising a one-piece truck frame of open-hearth steel and treads of ample size and flexibility to permit of the machine's movement or operation over soft or uneven ground. Each tread may be adjusted independently of the other and the entire unit is interchangeable

with a traction mounting by reason of which the machine may be adapted at will for use on the tracks or ground. This work of various kinds may be performed largely in-

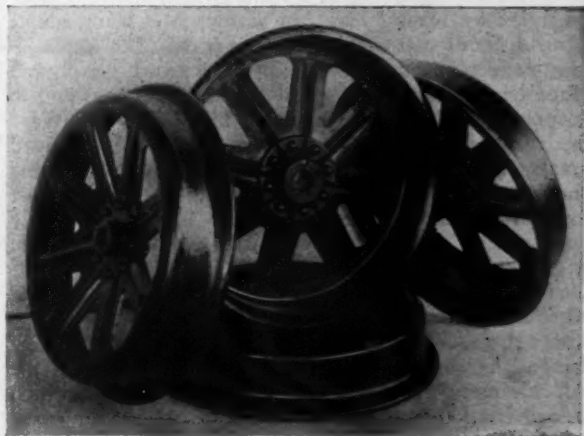


The Osgood 29 Steam Shovel on Caterpillar Mounting

dependent of the appropriateness of the condition for laying track. Self-propulsion in the machine is effected by direct gear drive.

A NEW PRESSED STEEL WHEEL FOR MOTOR CARS

THE Fairmont Gas Engine & Railway Motor Car Company, Fairmont, Minn., has recently developed its process of motor, hand and push car wheel manufacture to a point where it now makes its wheels entirely by the cold process, as distinguished from an all-hot or part cold

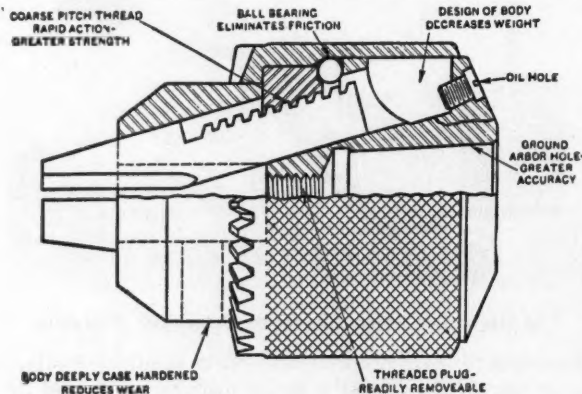


Fairmont Pressed Steel Motor Car Wheels

and hot process. Since the development of this process the work of making a wheel now consists of passing the initial plate through 26 operations, after which the malleable hub shown in the illustration is riveted in place and bored for the car axle. Pressing the steel cold is said to afford added stiffness for the same weight of material. As a result of this process, together with the simplicity of the remaining operations of manufacture, the company is presenting these wheels to the market as a less expensive type of equipment. The material from which the wheels are made is a high grade of deep drawing steel and the entire process of manufacture, including the boring of the hubs, is said to insure great accuracy in dimensions.

THE JACOBS DRILL CHUCK IMPROVED

THE important bearing which the drill chuck has upon the ease and satisfaction with which drilling operations are performed is well known to the maintenance forces accustomed to employing power drills in connection with their work. Chucks inclined to tighten with difficulty or to hold insecurely give rise to constant annoyance and often materially impair the usefulness of the whole machine. It is for this reason that develop-



The Jacobs Drill Chuck as Improved

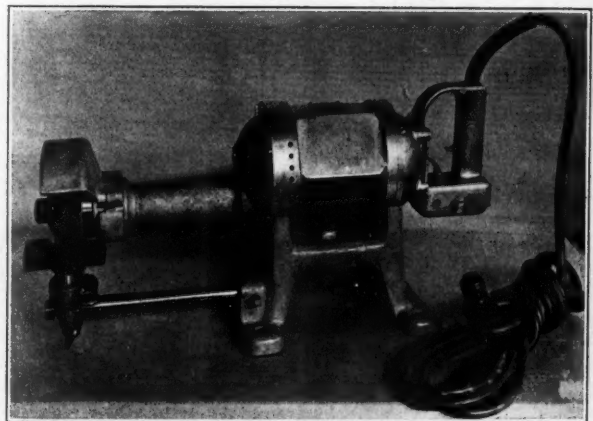
ments in chuck manufacture directed to the end of introducing new types or improving existing models merit attention. In some cases the application of the newer chuck to an old machine may be productive of results distinctly favorable.

The Jacobs chuck is of the tooth key and sleeve type (as distinguished from that requiring the use of a spanner wrench in tightening or loosening) and has been manufactured for several years, the various sizes being adapted to drills of capacities up to one inch. The improvements effected in the chuck lie in the outward design and other details designed to secure better proportions and to adapt the chuck to developments which have taken place in drilling methods. As improved, it is said to afford great holding power, requires little exertion in tightening and eliminates the need of holding the spindle against rotation during the drilling operation. The body is deeply case-hardened, but the taper hole is adequately soft for use on a hardened and ground arbor. Through the center of the body is drilled and tapped a hole for inserting rods or other materials through the chuck, this hole being fitted with a threaded plug which may be removed with a screw driver. An interesting feature of this chuck lies in the ball-bearings inserted between the nut and the body, which reduce friction to a minimum. By reason of the small amount of friction between the parts, it is possible to tighten the chuck with greater ease than formerly, thus

preventing undue wear on the keys, sleeves and other working parts and at the same time giving greater gripping qualities. An oil hole inserted in the back end of the chuck makes it possible to lubricate all of the working parts. By actual test the new chuck has shown that one-half the pressure on the key in tightening will produce the same results as in chucks of the previous design. Also the change in the pitch of the thread on the jaws has resulted in reducing by one-half the number of turns of the sleeve required to tighten or loosen the chuck. This type of chuck is the product of the Jacobs Manufacturing Company, Hartford, Conn.

A NEW PORTABLE ELECTRIC GRINDER

MAINTENANCE officers associated with work involving various grinding or cleaning operations, such as that of sharpening tools, smoothing castings or welds, removing rust or paint from metal surfaces prior to repainting, polishing metal fixtures, etc., will be interested in a portable electric grinder recently developed by the Black & Decker Manufacturing Co., Baltimore, Md. This tool is built along the same lines as the company's portable electric drills, a distinguishing feature of which is the so-called "pistol grip and trigger switch" control, this type of control eliminating the need of shift-



Black & Decker Portable Grinder with Bench Attachment

ing the hands in starting or stopping the machine.

The tool comprises a ½ hp. motor, a 5-in. by 1-in. grinding wheel, and a cord for attaching it to either direct or alternating current. It weighs 21 lb. While designed primarily as a portable grinder, provision is made for its use also as a bench tool through the detachable base and adjustable tool rack shown in the illustration. These bench attachments are supplied with the tool, together with two 5-in. by 1-in. grinding wheels, one fine and one coarse, a wire brush and a rag buffing wheel. Where electric power is available, it is evident that such a machine can frequently be used advantageously, affording as it does a means of performing work more rapidly or to better satisfaction than can be done by hand methods. The machine has grease lubrication throughout, forced air cooling, chrome nickel steel gears and shafts and an aluminum alloy housing.

THE SHORT LINE RAILROADS.—All purchasing for the short line roads of the United States is to be handled through a consolidated agency established in Washington. It is expected that this arrangement will offer a means of lowering the operating costs on these roads.



SIX MONTHS ago the "What's the answer?" column appeared in the *Railway Maintenance Engineer* for the first time. This department was created in the belief that there was a real service to be performed in addition to what had hitherto been afforded by providing a place where readers could discuss puzzling questions, present new theories for criticism, compare practices on other roads or in other localities, expose errors in methods that might well be called to the attention of others, and, in short, to conduct a department of information secondary in its practical value only to the convention.

So far 24 questions have been presented for discussion, on track, building, bridge and water service topics. All have been live questions, meriting the attention of all the readers in the department to which each applied. We know that a number of them had their origin in the knowledge of circumstances where misunderstanding was at least making unnecessary work. In fact, the question answered in this issue, "Should an air chamber of a pump be fitted with an air cock, and if so where?" was considered a good question, because the contributor knows of a pump repairer who, although in responsible charge of several pumping stations and a man of several years' experience, had placed air cocks in the tops of several air chambers and had given the pumpers to understand that they should be opened periodically to let all of the air out of the chamber, he believing that the air chamber was a trap with which to catch the air and from which to release it, rather than a vessel to hold air for the purpose of insuring uniform flow and absorbing shock in the line. The 24 questions submitted have received more than 24 replies, and these replies represented the opinions of architects, bridge and water engineers, superintendents of buildings, and supervisors of track, not forgetting to mention the trackman, whose opinions along with those of other craftsmen are well worth consideration and are always solicited for the column.

This record would seem to indicate that every reader can derive benefit from these discussions. Certainly many already have, judging from the letters which have been received, quotations from a few of which were given in the June issue. Readers should remember, however, that

they who derive the most benefit are usually those who participate in as well as read the discussions. Undoubtedly each reader has questions which it would not only be to his benefit to have discussed, but to other readers as well, and who will deny that the criticism that one reader might see fit to make of the answer to a question made by another might not be of distinct value to him who all along had considered his answer to be the correct one? If readers will bear this in mind the "What's the answer column" will undoubtedly grow still more in interest and value.

The following answers have been received to questions published in the May issue.

What Would Be Your Answer?

The following questions have been submitted and will be answered in the September issue:

- (1) Should ties be laid with the traffic or against it, and why?
- (2) What are the relative advantages, if there are any, of D. & M. ship lap and plain lumber for use in concrete forms?
- (3) What is the proper way of laying composition roofing—with the slope or crosswise to it, and why?
- (4) Will someone please tell me when a globe valve is preferred to a gate valve and vice versa?

REPLACING BROKEN WINDOWS

What is the most practical and economical plan for replacing broken window panes in stations, pump houses and other buildings scattered along the railroad?

So many glasses are broken in such buildings that setting the glass with putty is an expensive matter and also impracticable during winter months. Around shop buildings if glass is broken out during warm weather, its replacement is not so essential at that time, but when broken during winter months it must be replaced promptly. It has been a common practice in such cases to use brads or glazing points to hold the glass in place until the following spring. In many cases they were not fol-

lowed up and puttied at that time. Consequently the sash is subject to rapid decay. To get around this difficulty there has been quite a wide use of small quarter round moulding strips, similar to those used by the Pullman company, and other makers of passenger car equipment. These strips have proven decidedly superior to putty, both in cold and warm weather. Care should be taken, however, in using these strips to give them a coat of fresh paint so as to seal the joint between the moulding and the sash, and also make a tight joint between the moulding and the glass. This protects the sash against decay and also the brads, with which the moulding strips are attached, from corrosion.

Another method of setting glass that we have found satisfactory, so far as our experiments have gone, is to

use some one of the several makes of glazing compounds that are now on the market. These glazing compounds are, for the most part, coal tar products, with a liberal addition of asbestos fibre. There are also some plastic asphalt compounds available for this work. The former product is a modification of some of the plastic roof coatings that are on the market. This material has been modified sufficiently to make it applicable to setting glass. The men who have used these compounds for setting glass much prefer them to any materials used heretofore.

As these glazing compounds are invariably black, unless some of the special very high priced preparations are secured, there may be some objection to using them around certain classes of buildings, especially where the sash is painted white. A great many sash, however, on depots are painted black and on such buildings the color certainly would not be objectionable. On a great many other depots at less important points it would not make any particular difference, even though the sash were white and glazing material black. The color would certainly not be objectionable on pump houses, shop buildings and other buildings of that character.

F. E. KING, assistant engineer, Chicago, Milwaukee & St. Paul, St. Paul, Minn.

REMOVING BROKEN RAIL JOINTS

What kind of a break in an angle bar or other joint bar constitutes a dangerous condition, requiring the removal of the bar immediately?

The splice bar itself is but one of several factors which might enter into a determination of the need for its removal in case of partial failure. Of these, the following are probably among the most important: (1) Other features of the track at or near the joint which have a bearing on the substantiability of the latter. (2) The character of traffic carried by the track.

Assuming average main line, or equivalent, conditions to be under consideration, a good rule to go by is the safety slogan, "when in doubt do it the safe way." A fractured splice bar must, it would seem, create a measure of doubt as to its stability; hence, remove it.

A particularly serious failure is one occurring between the two middle bolts and especially when it happens to be in an outside bar. Complete failure at this location is actually dangerous, consequently any start toward such a situation is potentially dangerous.

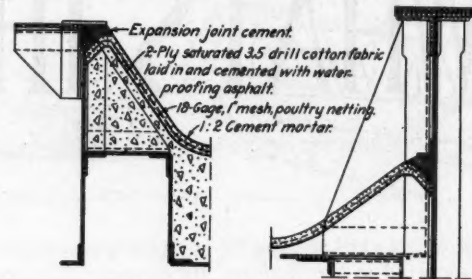
E. D. SWIFT, engineer, maintenance of way, Belt Railway of Chicago, Chicago.

WATERPROOFING VERTICAL JOINTS BETWEEN STEEL WORK AND CONCRETE

What is an effective method for sealing vertical joints between steel work and concrete, particularly the joints made with the concrete floors in through girder bridges, so as to prevent the corrosion of the steel?

The practice on the Chicago & North Western in sealing the vertical joints between steel work and concrete, particularly in the case of through girder bridges, is to slope the waterproofing downward towards the girders for a distance of six and eight inches and fill the space so formed with an elastic cement. A description of the entire method of waterproofing a floor in a typical through girder bridge will perhaps make this method clearer. The deck of the bridge is first thoroughly broomed and cleaned, after which a two-ply membrane waterproofing coating is applied, this coating in turn being covered by a 1½-in. layer of cement mortar reinforced with poultry netting. The surface of the concrete deck rising as it approaches

the bridge girders from the line of the ends of the ties, the waterproofing slopes upward with it until within six or eight inches of the steel where the concrete takes a downward slope. The waterproofing sloping downward at this point thus forms a



How the Joint Is Protected

pocket several inches deep which, as stated, is filled with expansion joint cement up to the angle or flashing plate riveted to the girder above the crest of the waterproofing slope. These flashing plates or angles give a bonding surface to the cement which prevents cracks from forming along the surface of the girder web, and the pockets formed by sloping the waterproofing downward prevent its dislodgment.

O. F. Dalstrom, engineer of bridges, Chicago & North Western.

PROPER USE OF AIR COCKS

Should an air chamber on a pump be fitted with an air cock and if so, where?

In my estimation, an air cock and a drain cock are very necessary on the air chamber on a pump. When no easy method of draining the water from an air chamber and filling it with air is provided, the entire chamber eventually fills with water and no air cushion is provided. On at least one occasion I have traced blown-out lead joints in a line, that for many years gave no trouble, to the air chamber on the pump being entirely filled with water. Draining this air chamber relieved the trouble at once.

After considerable experimenting I now place an air cock at the top of the air chamber and a drain cock near the bottom. These are opened frequently, when the pump is idle, thus draining the air chamber of water and insuring a good air cushion at all times.

B. W. DE GEER, engineer, water service, Great Northern.

SPLIT POSTS AND ROUND POSTS

IS A SPLIT fence post as durable as a round fence post? This question is frequently asked of the U. S. Forest Products Laboratory. The fact is, that one kind of post will last about as long as the other if the amount of heartwood is the same in both, but if the percentage of sapwood is increased by splitting, the split post will be less durable, and if the percentage of heartwood is increased it will be more durable than a round one. Posts of spruce, hemlock or any of the true firs are exceptions to this rule, because their heartwood and sapwood are about equally durable. When posts are to be treated with creosote or other preservative, a round post is preferable to a split post, because of the comparative ease with which the sapwood can be treated. The heart faces on split posts do not, as a rule, absorb preservative well. Split red oak posts will take treatment, because the wood is very porous, but the heart faces of split posts of many other species, notably white oak, red gum and Douglas fir, resist the penetration of oil, even under pressures.



AMERICAN RAILWAY ENGINEERING ASSOCIATION

The Board of Directors and officers of the association will meet in Montreal on July 13 for consideration of regular business of the association. The secretary now has the June bulletin or year book of the association in progress of preparation. This will contain lists of officers, members, personnel of committees, etc. The publication of the manual will follow the completion of the year book.

THE ROADMASTERS' ASSOCIATION

Plans are maturing rapidly for the thirty-ninth annual convention which will be held at the Auditorium hotel, Chicago, on September 20 to 22, inclusive. A meeting of the executive committee and the members of other committees of the association will be held at Cleveland on Saturday, July 9, to consider the reports which will be presented at the convention and to complete other arrangements.

The Track Supply Association will present its tenth annual exhibit at the Auditorium hotel, Chicago, in connection with the convention of the Roadmasters' Association. Although it is nearly three months before the convention, practically all of the space available for exhibit purposes has been contracted for, 46 firms having already arranged for space as follows:

Air Reduction Sales Company, New York City.
 American Chain Company, Bridgeport, Conn.
 American Hoist & Derrick Company, St. Paul, Minn.
 American Steel & Wire Company, Chicago.
 American Valve & Meter Company, Cincinnati, Ohio.
 Anchor Company, New York City.
 Balkwill Manganese Crossing Company, Cleveland, Ohio.
 Bucyrus Company, South Milwaukee, Wis.
 Carbic Manufacturing Company, Duluth, Minn.
 Chicago Malleable Casting Co., Chicago.
 Crerar Adams & Co., Chicago.
 Duff Manufacturing Company, Pittsburgh, Pa.
 Elliot Frog & Switch Company, East St. Louis, Ill.
 Fairbanks Morse & Co., Chicago.
 Fairmont Gas Engine & Railway Motor Car Company, Fairmont, Minn.
 Hauck Manufacturing Company, New York City.
 Hayes Track Appliance Company, Richmond, Ind.
 Ingersoll-Rand Company, New York City.
 Kalamazoo Railway Supply Company, Kalamazoo, Mich.
 Kilbourne & Jacobs Manufacturing Company, Columbus, Ohio.
 Lundie Engineering Corporation, New York City.
 Maintenance Equipment Company, Chicago.
 Mudge & Co., Chicago.
 National Lock Washer Company, Newark, N. J.
 National Malleable Castings Company, Cleveland, Ohio.
 Northwestern Motor Company, Eau Claire, Wis.
 Oxweld Railroad Service Company, Chicago.
 P & M Company, Chicago.
 Positive Rail Anchor Company, Marion, Ind.
 Pocket List of Railroad Officials, New York City.
 Q. & C. Company, New York City.
 Rail Joint Company, New York City.
 Railroad Supply Company, Chicago.
 Railway Review, Chicago.
 Ramapo Iron Works, Hillburn, N. Y.
 Reade Manufacturing Company, Hoboken, N. J.
 Reliance Manufacturing Company, Massillon, O.
 Sellers Manufacturing Company, Chicago.
 Simmons-Boardman Publishing Company, New York City.
 Templeton, Kenly & Co., Ltd., Chicago.

Track Specialties Company, New York City.
 Union Switch & Signal Company, Swissvale, Pa.
 Verona Tool Works, Pittsburgh, Pa.
 Warren Tool & Forge Company, Warren, Ohio.
 Wharton, Jr., & Co., Wm., Easton, Pa.
 Woolery Machine Company, Minneapolis, Minn.
 Wyoming Shovel Works, Wyoming, Pa.

THE MATERIAL MARKET

THE MARKET report appearing in last month's issue pointed to the then prevailing tendency to shade the prices established by the United States Steel Corporation and its subsidiaries in April, but at that time the reductions were not sufficiently definite to warrant recording them. This condition, however, has changed. Price shading has become so general in some lines that it is a matter of common knowledge, and as a consequence the table of iron and steel prices given below shows upper and lower limits of price for most items. A new price for cast iron pipe \$10 below that given a month ago has been established, but even this is not holding up well, and some sales at lower levels have been recorded. The reason for this general tendency of the iron and steel market is obvious—an exceedingly small demand.

	Prices in Cents Per Pound			
	May 20	June 17		
	Pittsburgh	Chicago	Pittsburgh	Chicago
Track spikes	3.40	3.78	3.25 to 3.40	3.58 to 3.78
Track bolts	4.35	4.73	4.00 to 4.35	4.58 to 4.73
Angle bars	2.75	2.75		2.75
Tie plates, steel.....	2.50	2.50		2.50
Tie plates, iron.....	3.00	3.00		3.00
Plain wire	3.00	3.38	2.75 to 3.00	3.13 to 3.38
Wire nails	3.25	3.63	3.00 to 3.25	3.38 to 3.63
Barbed wire, galv.....	3.85	4.23	3.85	4.23
C. I. pipe, 6 in. or larger (per ton)		64.10		54.10
Plates	2.20	2.58	1.90 to 2.20	2.28 to 2.58
Shapes	2.20	2.58	2.00 to 2.20	2.48 to 2.58
Bars (steel)	2.10	2.48	2.00 to 2.10	2.23 to 2.48

Last month there was every indication that the scrap market had reached the bottom, but because of a further slump during the past month prices are now back at approximately the level recorded in the May issue.

	Chicago		St. Louis	
	Per Gross Ton		Per Net Ton	
Relaying rails	\$30.00 to \$35.00	\$27.50 to \$32.50		
Rerolling rails	13.00 to 13.50	12.50 to 13.00		
Rails less than 3 ft. long.....	13.00 to 13.50	12.00 to 12.50		
Frogs and switches cut apart.....	11.00 to 11.50	12.00 to 12.50		
No. 1 railroad wrought.....	9.50 to 10.00	10.50 to 11.00		
Steel angle bars.....	11.00 to 11.50	10.25 to 10.75		

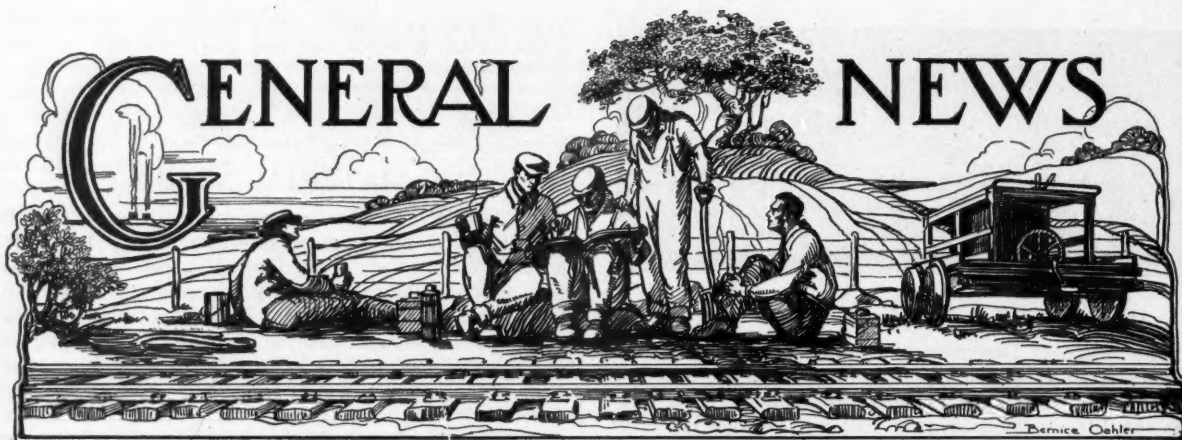
An examination of the table of lumber prices given below shows that very little change has taken place, with an actual advance in prices in some cases. This is not so much an evidence of increased demand as an indication that the price has gone as low as it is possible for the manufacturer to sell it without an actual loss in out of pocket cost. For the week ending June 11 the production in western Washington and Oregon was 30 per cent below normal.

Southern Pine Mill Prices

	May	June
Flooring, 1 x 4, B. and B. flat.....	\$30.31	\$32.33
Boards, 1 x 8, 14 and 16, No. 1.....	22.75	23.84
Dimension, 2 x 4, 16, No. 1.....	21.60	22.61
Dimension, 2 x 10, 16, No. 1.....	20.41	22.92
Timbers, 4 x 4 to 8 x 8, No. 1.....	19.95	20.44
Timbers, 3 x 12 to 12 x 12, No. 1.....	26.75	28.13

Douglas Fir, Seattle Prices

	May	June
Flooring, 1 x 4, No. 2, clear, flat.....	\$22.00	\$22.00
Boards, 1 x 6, 6 to 20, No. 1, common.....	12.00	12.00
Dimension, 2 x 4, 16, No. 1, common.....	12.50	12.50
Dimension, 2 x 10, 16, No. 1, common.....	12.50	12.50
Timbers, 6 x 6 to 8 x 8, No. 1, common.....	17.00	17.00
Timbers, 10 x 10 to 12 x 12, rough.....	16.00	16.00



Putting his railroad on a factory basis is the present aim of Henry Ford, president of the Detroit, Toledo & Ironton. To this end it has been announced that from July 1 the minimum daily wage rate of \$6 now prevailing in the Ford factory will be extended to all employees of the road, with bonuses for demonstrated efficiency. Also railroad employees will work but six days a week, the same as workmen in other industries, no operations to be carried on from 6 p. m., Saturday, to 6 a. m., Monday, excepting those required to move milk trains.

Pronounced success in safety work has been made by the Northern Pacific during the last five years, according to its reports that fatal accidents to both employees and non-employees have been reduced 75 per cent and casualties to employees 60 per cent. In 1916 the road had 151 fatalities, while in 1920 there were but 52. Considering employees only, the record of 1916 shows one injured per month for each 100 employees, while in 1920 this was reduced substantially by one-half and in the four months ending with March, 1921, the percentage was further reduced by 10 per cent.

The safety organization of the Northwestern Pacific merits much attention as a means of perpetuating an interest in safety proceedings on the part of the employees, so essential to the successful working of programs of this kind. The organization comprises a general safety agent, a safety supervisor and five subordinate safety committees. The constituency and the method of forming the committee are the interesting parts of the organization. Each committee is made up of officer members chosen by the managements, and by employee members, of the latter of which there is one representative for each brotherhood or other employee organization. Each employee committeeman holds office for a period of six months and is chosen by a system whereby the retiring representative of an organization nominates three candidates from his organization, these candidates then being voted upon by ballot. In the election employees ballot only upon the candidates for their own organization.

A bad freight car situation will inevitably occur before long unless great strides are made in reducing the number of cars now in bad order. Of the 310,000 cars waiting repairs (a number which incidentally is more than 13 per cent of the number of cars owned as compared with an average of 5.7 per cent for the period prior to federal control), 228,200, or 74 per cent, are in need of heavy repairs. With prospects of an accelerating business revival which will undoubtedly occur, the railroads have about 134,000 fewer cars immediately fit for service than were available even during the period of heavy traffic last year. In order to handle a volume of traffic approaching that of last summer and early fall, therefore, it will be necessary to reduce the present number of bad order cars by at least 134,000, and this reduction must come very largely from the 228,000 cars requiring the heavy repairs. The seriousness of this condition is apparent when it is known that normally the daily output of cars receiving heavy repairs only averages about ten per cent of the total.

"Taxation is the greatest burden of industry today," said Paul Shoup, vice-president of the Southern Pacific, in a recent address before the California Bankers' Association at San Diego. The Southern Pacific, he said, had in 1912 before payment of taxes, interest and other fixed charges, \$23,556,970 as that part of its earnings apportioned to California, out of which in the succeeding fiscal year it paid to that state \$2,954,084 in taxes. In 1920 its earnings apportioned to California on the same basis were \$19,364,560, out of which it has to pay in the succeeding fiscal year under the new tax laws \$8,157,000. The ability of the company to give service is impaired as a result of this condition, it was said, and its consequent inability to reduce freight rates and passenger fares in turn has its effect on other industries.

Owners of railroad securities, having become concerned in the present situation of the railroads, have appointed a Board of Economics and Engineering for the purpose of investigating the possibility of effecting substantial economies in the operation of the railroads. A notable feature of this board is that the members are all men of wide experience in railroad work, yet entirely free from connections or affiliations with railway companies, financial institutions or governmental agencies which might restrict in any way their activities. The personnel of the board as appointed by the national association includes John F. Stevens, at one time chief engineer and general manager of the Great Northern, chief engineer and vice-president of Chicago, Rock Island & Pacific, vice-president New York, New Haven & Hartford, and chief engineer Panama Canal Commission. It also includes John F. Wallace, at one time chief engineer and general manager of the Illinois Central; W. L. Darling, at one time chief engineer of the Chicago, Rock Island & Pacific and the Northern Pacific; F. A. Molitor, at one time chief engineer of the Choctaw, Oklahoma & Gulf and Philippine railway construction; L. B. Stillwell, consulting engineer and railroad promotor, and W. W. Colpitts, at one time chief engineer of the Kansas City, Mexico & Orient.

The Ninth Congress of the International Railway Association will be held at Rome, Italy, from April 18 to May 1, 1922. Among the subjects to be discussed are the following: Construction of Roadbed and Track—By C. H. Ewing, vice-president of the Philadelphia & Reading; K. Alberg, principal engineer of the bureau of roadway construction of the Swedish State Railways; E. F. C. Trench, chief engineer of the London & North Western; M. Henry, associate chief engineer of way and works of the Eastern Railway (France), and M. Candelier, chief engineer of surveys, plant and structures, of the Northern Railway of France. Maintenance and Supervision of Track—By Earl Stimson, chief engineer of maintenance of the Baltimore & Ohio; C. J. Brown, chief engineer of the Great Northern (England), and G. Barbieri, chief of the works division of the Italian State Railways. Special Steels—By W. C. Cushing, engineer of standards of the Pennsylvania; M. Mesnager, professor and director of the test laboratory of the School of Bridges and Highways (France), and M. Sand, vice-president of the directorate gen-

eral of the Swiss Federal Railways. Reinforced Concrete—By G. A. Haggander, bridge engineer of the Chicago, Burlington & Quincy; W. W. Grierson, chief engineer of the Great Western (England); C. Leemans, engineer of way and works of the Holland Railway; P. M. Buelow, chief of the bureau of engineering of the Danish State Railways, and M. Golard, chief engineer and director of special service and works of the Belgian State Railways. Workmen's Dwellings—A. F. Banks, president of the Elgin, Joliet & Eastern, and F. Lalli, chief of the works division of the Italian State Railways.

ADDITIONAL GOVERNMENT PAYMENTS TO RAILROADS

Since the June issue of the *Maintenance Engineer* the Interstate Commerce Commission has certified to the Treasury Department that the following amounts are due various carriers as partial payments on account of the six months' guaranty:

Ann Arbor	\$ 75,261
Arizona Eastern	390,000
Bath & Hammondsport	9,000
Central New York Southern	6,000
Chicago & Alton	20,000
Chicago & North Western	800,000
Chicago, Detroit & Canada	55,000
Chicago, Milwaukee & St. Paul	3,000,000
Cincinnati, Saginaw & Mackinaw	90,000
Detroit, Grand Haven & Milwaukee	250,000
Detroit & Huron	7,500
Detroit & Mackinac	50,000
Fort Worth Belt	12,500
Frankfort & Cincinnati	12,500
Galveston, Harrisburg & San Antonio	150,000
Galveston Wharf	100,000
Grand Trunk, as lessee of Atlantic & St. Lawrence	425,000
Grand Trunk of Canada	22,000
Grand Trunk Western	1,000,000
Houston, East and West Texas	145,000
Houston & Texas Central	900,000
Kanawha & Michigan	103,000
Lake Charles & Northern	21,000
Lake Erie & Western	360,000
Leavenworth Terminal	18,000
Louisiana & Texas Railroad & Steamship Company	85,000
Louisville Bridge & Terminal	150,000
Maryland & Pennsylvania	75,000
Michigan Air Line	30,000
Michigan Central	260,000
Minneapolis & St. Louis	390,000
Missouri & North Arkansas	27,000
Missouri Pacific	1,100,000
Mount Hope Terminal	4,000
New York & Pennsylvania	15,000
New York, Susquehanna & Western	205,000
Nez Perce & Idaho	6,000
Ocala Southern	15,000
Ohio River & Western	70,000
Penn Yan & Lake Shore	2,000
Peoria & Pekin Union	55,000
Peoria Railway Terminal	87,000
Pontiac, Oxford & Northern	110,000
Rutland	225,000
Shearwood	2,000
Southern Pacific	4,200,000
St. Louis-San Francisco	30,000
Toledo, Saginaw & Muskegon	75,000
Toledo & Ohio Central	105,000
Ulster & Delaware	25,000

The commission has also issued a certificate for the final amount due under the guaranty to the Electric Short Line for \$14,993.67.

In addition to the partial payments made, the United States Railroad Administration reports the following final settlements, and has paid out to the several roads the following amounts: Port Bolivar Iron Ore Railway, \$35,000; Chicago, Milwaukee & Gary, \$200,000; Bangor & Aroostook, \$575,000; Southern Railway, \$6,000,000; Chicago & Western Indiana, \$450,000; Belt Railway of Chicago, \$140,000, and the Richmond Terminal Railway, \$17,157.42. These claims include all disputed items between the railroads and the administration during federal control.

PERSONAL MENTION

GENERAL

W. J. Edwards, formerly roadmaster and recently superintendent of the Alabama Great Southern, has been promoted to general superintendent of the Southern, with headquarters at Chattanooga, Tenn.

ENGINEERING

Colonel C. N. Monsarrat has been appointed consulting engineer of bridges of the Canadian National, with headquarters at Toronto.

J. M. R. Fairbairn, chief engineer of the Canadian Pacific, and also president of the Engineering Institute of Canada, was given the degree of Doctor of Science by the University of Toronto at Toronto, Canada, on June 9.

I. H. Schram, superintendent of terminals of the Erie at Marion, Ohio, has been appointed division engineer, with the same headquarters, succeeding **H. S. Elliott**, who has resigned. The position of superintendent of terminals at Marion has been abolished.

T. M. Pittman, Jr., assistant engineer on the Louisiana division of the Illinois Central, with headquarters at McComb, Miss., has been promoted to roadmaster of the Mississippi division, with headquarters at Water Valley, Miss. **E. H. Lewis**, instrumentman, with headquarters at Helena, Ark., has been promoted to assistant engineer, succeeding Mr. Pittman. **R. W. Cowgill**, assistant engineer of the Indiana division, with headquarters at Mattoon, Ill., has been transferred to the Iowa division, with headquarters at Fort Dodge, Iowa. **W. D. Schenefield** has been transferred from the bridge department to the Indiana division, succeeding Mr. Cowgill. **C. D. Turley**, assistant engineer, valuation department, with headquarters at Chicago, has been transferred to Chicago, succeeding **J. C. Porter**, deceased.

P. G. Lang, Jr., whose promotion to engineer of bridges of the Baltimore & Ohio was announced in the June issue, was born at Philadelphia, Pa., and received his education at the University of Pennsylvania, graduating in 1905. During 1905 and 1906 he was employed at the Pencoyd plant of the American Bridge Company, leaving in the latter year to become bridge designer for the Carolina, Clinchfield & Ohio at Johnson City, Tenn. In December, 1907, he entered the service of the Baltimore & Ohio as assistant engineer in the bridge department. In December, 1917, he was promoted to chief bridge draftsman and on August 1, 1918, to assistant engineer of bridges, which position he held at the time of his recent promotion. Since October, 1919, Mr. Lang has been in complete charge of bridge work for the company.



P. G. Lang, Jr.

TRACK

O. C. McIntosh has been appointed roadmaster on the Toledo, St. Louis & Western, with headquarters at Charleston, Ill., succeeding **James O'Hair**, deceased.

E. A. Howland, assistant roadmaster on the Northern Pacific, with headquarters at Fargo, N. D., has been promoted to roadmaster, with headquarters at Carrington, N. D., in

place of **W. E. Fitzsimons**, who has been transferred to Mandan, N. D., succeeding **C. W. Coil**, transferred.

C. F. Nelson, roadmaster on the Northern Pacific, with headquarters at Mandan, N. D., has been promoted to general roadmaster of the Montana division, with headquarters at Livingston, Mont.

B. O. Thistle, roadmaster of the Placerville district of the Southern Pacific, Pacific System, with headquarters at Sacramento, Cal., has been transferred to the Marysville district, with headquarters at Marysville, Cal., succeeding **F. H. Depew**, who has been transferred to the Placerville district in place of Mr. Thistle.

J. A. Herbert, whose promotion to roadmaster on the Dominion Atlantic, with headquarters at Yarmouth, N. S., was noted in last month's issue under the name of Janvier Herbert, was born at Farnham, Que., Canada, on January 18, 1889. Mr. Herbert entered railway service as a call boy on the Canadian Pacific in June, 1903, remaining at this work until in July, 1904, when he was promoted to car checker. In May, 1910, he left this work to become a track man in one of the Canadian Pacific's section gangs, serving subsequently on various sections and extra gangs until September, 1913, when he was promoted to foreman, a position which he continued to hold until his recent promotion to roadmaster, as already noted.

William Ronallo, whose promotion to the position of roadmaster of the Chicago terminals of the Chicago, Milwaukee & St. Paul, with headquarters at Chicago, was noted in the June issue, was born in Italy on August 12, 1877. He entered railway service in 1890 as a water boy on the Chicago & Western Indiana, leaving this road in 1893 to go with the Illinois Central as a section laborer. From 1896 until 1899 he served as an assistant foreman of extra gangs, being promoted to foreman in the latter year. On May 15, 1905, Mr. Ronallo left the employ of the Illinois Central and entered the service of the Chicago, Milwaukee & St. Paul as a section foreman in the Chicago terminals, subsequently serving as foreman of various track gangs and acting roadmaster.

OBITUARY

Coleman King, track supervisor on the Long Island, with headquarters at Jamaica, N. Y., died on June 18. Mr. King was born in Ireland in 1862, was brought to America by his parents in 1867, and at the age of 12 entered railway service. In 1878, at the age of 16, he became foreman on the Great Northern and held various positions in that section of the country until 1904, when he was appointed supervisor of track for the Long Island, with headquarters at Jamaica, N. Y., which position he held at the time of his death. Mr. King was widely known in railway circles, being past president and treasurer of the Roadmasters' and Maintenance of Way Association of the United States. He was recently elected the first president of the Metropolitan Roadmasters' Association of New York State.



Coleman King

PURCHASES AND STORES

W. J. Sidey, general storekeeper of the Buffalo, Rochester & Pittsburgh, has been assigned other duties and the position of general storekeeper has been abolished. Officers and employees heretofore reporting to the general storekeeper will report to the chief engineer.

John E. Mahaney, general storekeeper of the Norfolk Southern, has been appointed superintendent of stores of the Chesapeake & Ohio, with offices at Huntington, W. Va.

CONSTRUCTION NEWS

The Atchison, Topeka & Santa Fe is contemplating additions to its power house at Albuquerque, N. M., to cost approximately \$150,000. This company noted in the May issue as accepting bids in co-operation with the railroad Y. M. C. A. for the construction of an addition to the Y. M. C. A. building at Topeka, Kansas, to cost approximately \$25,000, has awarded a contract for this work to Jerome Moss, Chicago.

The Atchison, Topeka & Santa Fe will also shortly accept bids for the installation of two new 120-ft. turntables, one at Winslow, Ariz., and the other at Needles, Cal., to cost about \$45,000 each.

The Chicago, Burlington & Quincy is accepting bids for the remodeling of its railway mail terminal building at Omaha, Neb., and has closed its bids for the grading in connection with the track elevation at Broadway, Benton and Clark streets, Aurora, Ill., the latter work to involve the expenditure of approximately \$50,000.

The Chicago & Eastern Illinois contemplates the construction of a two-story brick railroad Y. M. C. A. building at Mitchell Yard, Ill., to cost \$100,000.

Chicago & Illinois Midland—This company has awarded a contract for the construction of a 150-ton concrete coaling station at Humphrey, Ill., to the Ogle Construction Company, Chicago.

The Chicago, Rock Island & Pacific contemplates the construction of a new power plant at Trenton, Mo., on the site of its shops which were destroyed by fire. This company has awarded a contract to the Roberts & Schaefer Company, Chicago, for supplying the coal and sand handling equipment for a coaling station at El Reno, Okla. The station, which will replace a similar structure destroyed by fire, will be built by company forces. This company has also awarded a contract to the Railway Water & Coal Handling Company, Chicago, for the construction of a new water treating plant at West Liberty, Iowa, and is accepting bids for the construction of a coaling station at El Reno, Okla., to replace a structure which burned, and for new coaling stations at Enid, Okla., and McFarland, Kan.

The Chicago Union Station Company contemplates widening Canal street, between Van Buren and Jackson streets, Chicago. This company noted in the June issue as having closed bids on May 26 for the completion of the filled portion of the Polk street viaduct, Chicago, and the construction of a viaduct on Van Buren street, between Canal street and the Chicago river, has awarded contracts for this work to the Underground Construction Company, Chicago.

The Detroit-Toledo Shore Line has awarded a contract to the Ogle Construction Company, Chicago, for the construction of a 70-ton steel coaling station at Dearborn, Mich.

The Illinois Central has awarded a contract to W. J. Zitterell, Webster City, Iowa, for the construction of a viaduct over Hawkeye Highway near Earlville, Iowa, at a cost of approximately \$50,000. This company has also awarded a contract to the Ellington-Miller Company, Chicago, for an extension to its roundhouse at Paducah, Ky., to cost approximately \$15,000. R. L. Brazier, La Center, Ky., has been awarded a contract for improvements to the yards at Paducah, Ky., to cost about \$10,000. The road has also awarded a contract on its Yazoo & Mississippi Valley lines to E. H. Walsh & Company, Memphis, Tenn., for the construction of a brick yardmaster's office at Baton Rouge, La., to cost \$12,000. A contract for concrete culvert work in connection with the improvements to the yards at Clinton, Ill., has been awarded to Bates & Rogers, Chicago, at a cost of about \$25,000. A contract for the construction of additions to its roundhouse at Waterloo, Ia., has been awarded to W. J. Zitterell, Webster City, Iowa. The company has also awarded a contract to M. J. Roach, Memphis, Tenn., for grading in connection with the construction of yard and storage tracks

at Sarpy, La., and contemplates the construction of an engine house at Herrin, Ill., to be built by company forces. The company is now accepting bids for the construction of a new water treating plant at Amboy, Ill., to cost \$30,000.

The International & Great Northern is erecting a new three-story office building with dimensions of 46 ft. by 52 ft. at San Antonio, Tex.

The Louisville & Nashville has awarded a contract to the Roberts & Schaefer Company, Chicago, for the installation of three N. & W. type mechanical cinder handling plants at Corbin, Kentucky.

The Louisiana Railway & Navigation contemplates the construction of a passenger station at Girod and Rampart streets, New Orleans, La., on a site purchased by the road some time ago.

The Missouri Pacific has awarded a contract to Joseph E. Nelson & Sons, Chicago, for the construction of a water station at Bush, Illinois, which is estimated to cost between \$40,000 and \$50,000, and has awarded contracts to Joseph E. Nelson & Sons, Chicago, in connection with improvements to its terminal at Hazard, Ky., for the construction of a roundhouse, machine shop, oil storage building, car department building, storage and office building, lavatory building and engineers' locker and register building. The total cost of the latter project is approximately \$180,000.

The Pittsburgh & West Virginia has let a contract for the construction of the proposed Bell branch into the coal fields owned by John A. Bell of Pittsburgh. The branch involves the building of $3\frac{1}{4}$ miles of track and is to be completed by December 16. The construction work will start at once.

The San Antonio & Aransas Pass contemplates the construction of a new passenger station at Taft, Texas.

The Southern Pacific has awarded a contract for the construction of a tunnel, 1420 ft. long, eliminating a trestle on the west bank of the Willamette river, about 7 miles from Portland, Ore., to the Hauser Construction Company, Portland.

The Virginian is accepting bids for the construction of additions to its shops at Elmore, W. Va.

The Wabash, which was noted in the June issue as accepting bids for the construction of a brick or stucco passenger station at Macon, Mo., with dimensions of 122 ft. by 24 ft., has awarded the contract to Joseph E. Nelson & Sons, Chicago. The company is accepting bids for the construction of a new 100-ft. turntable with a concrete base at Tilton, Illinois.

The Board of Transportation of Nashville, Tenn., has awarded a contract to Foster, Creighton & Company, Nashville, for the construction of a rail and river terminal building in that city to cost about \$300,000. The structure will be a five-story reinforced concrete dock and warehouse, 140 ft. by 300 ft., and will be equipped with elevators and cranes for handling package freight.

IRON AND STEEL

The Alaskan Engineering Commission has ordered 10,000 tons of rails and accessories from the Tennessee Coal, Iron & Railroad Company, to be rolled at the Ensley, Ala., mills.

Mitsui & Co., New York, has ordered 550 tons of 60-lb. rail and accessories from the United States Steel Products Company for use on the Hanshin Electric Railway, Japan.

A record in train loading for all railroads was recently made on the Virginian when a train of 100 loaded 120-ton cars of coal aggregating 16,000 tons gross was handled from Princeton, W. Va., eastward to Roanoke, Va., a distance of 97 miles, with one locomotive except in starting the train and on a 0.6 per cent grade between Rich Creek and Merri-mac, a distance of 10 miles, where pushers were required. This train was a test train run to demonstrate what could be done with the new 120-ton cars and the heavy power of the Virginian and furnishes a classic example of the results possible with high grade construction in roads and with well adapted power.

SUPPLY TRADE NEWS

GENERAL

The Standard Pressed Steel Company has removed its headquarters from Philadelphia to Jenkintown, Pa.

The Canton Foundry & Machine Company, Canton, Ohio, has removed its New York City office from the Grand Central Palace to 45 West Eighteenth street.

The Concrete Mixing & Placing Company has removed its office from 123 West Madison street to 802 Great Northern building, 20 West Jackson boulevard, Chicago.

The Steel Fabricating Corporation recently completed its new works and general offices at Michigan City, Indiana, and has removed its executive headquarters from Harvey, Illinois, to Michigan City.

The Vacuum Oil Company, New York City, has opened new branch offices at Buffalo, N. Y., and Dallas, Tex. The Buffalo office will cover New York State west of the Hudson river and the Dallas office the states of Texas and Oklahoma.

The Dayton-Dowd Company, a manufacturer of centrifugal pumps, Quincy, Ill., has opened a district sales office in the Pioneer building, St. Paul, Minn., where the company will be represented by George M. Kenyon Company.

The Jones & Laughlin Steel Company, Pittsburgh, Pa., which was reported in the June issue as having purchased land in the Chicago district for industrial development, advises that no such purchase has been made.

The Link-Belt Company, Chicago, has acquired the stock of the H. W. Caldwell & Son Company, Chicago, and Frank C. Caldwell has been elected a director of the Link-Belt Company. The Caldwell Company's plant will continue to operate under separate corporate existence, under its present name, and the plant management will remain substantially the same as heretofore.

The Master Tool Company, 20 East St. Clair avenue, Cleveland, Ohio, has been organized under the laws of Ohio to manufacture a new line of pneumatic tools, and will specialize in the reclaiming of all types and makes of same. The officers of the company are: J. Nightingale, president; Charles F. Overly, vice-president and general manager; William Eckert, secretary-treasurer. C. F. Overly is manager of sales.

The Manufacturers Exhibition Company, Inc., has established a permanent world market for machinery in the building occupying the block on Sixth avenue, Eighteenth street and Nineteenth street, New York City. The company's plans include American and international promotion of the sale of all American manufactured mechanical products. L. R. Duffield, who was general manager of the Philadelphia Bourse for over ten years and recently general manager of the International Exposition of Industries, is president and general manager of the Manufacturers Exhibition Company.

The Esterline Company, Indianapolis, Ind., will in the future be known as the Esterline-Angus Company. The Esterline Company was organized by J. W. Esterline in 1900 and was incorporated in 1906. D. J. Angus became associated with Mr. Esterline in 1910 in a consulting engineering practice and in 1917 became a stockholder and director of the Esterline Company. Mr. Angus has been responsible for the development of three new types of recording meters, known as the k.v.a. meter, the concentration meter and the graphic ohm-meter.

The directors of the Greenfield Tap & Die Corporation, Greenfield, Mass., on June 9, voted to purchase the entire capital stock of the Greenfield Machine Company, Greenfield, manufacturers of cylindrical and universal grinders, and the Morgan Grinder Company, Worcester, manufacturers of internal grinders. This combination, together with the machines now produced by the Greenfield Tap & Die Corpora-

tion, will constitute the machine division of the Greenfield Tap & Die Corporation. The operation and organization of both plants will remain the same for the present, although eventually the Worcester plant will be moved to Greenfield.

The Rail Steel Products Association, at the annual meeting held at New York recently, elected the following officers: E. H. Hughes, vice-president, Franklin Steel Works, president; D. E. Sawyer, sales manager, Pollak Steel Co., secretary; Arthur S. Hook, vice-president, Calumet Steel Co., treasurer.

PERSONAL

Roy G. Owens, vice-president in charge of sales of the Lakewood Engineering Company, Cleveland, Ohio, has resigned.

T. G. Windes, Jr., sales engineer of the Refinite Company at Omaha, Neb., has been appointed sales engineer of the International Filter Company at Chicago.

Max Grant, manager of technical railway sales of the Glidden Company, Cleveland, Ohio, has left the service of that company to become manager of the railway paint department of the Acorn Refining Company, Cleveland.

Ward A. Miller, manager of the wire products division of the Midvale Steel and Ordnance Company at Philadelphia, Pa., has been appointed district manager of sales at the Chicago office of the company.

P. R. Letts has been appointed office manager of the industrial bearings division of the Hyatt Roller Bearing Company, New York, succeeding **G. J. Traendly**, who is now office manager of the General Motors Corporation, New York.

C. W. Cross has been appointed railroad representative of the Torchwood Equipment Company, Chicago. Mr. Cross was until June 1 manager of western railroad sales for the Chicago Pneumatic Tool Company.

M. E. Lisle, assistant to the president of the Terminal Engineering Company, Inc., 17 West Forty-fourth street, New York City, has been elected vice-president, and **M. E. Peck**, office manager, has been elected secretary and assistant treasurer.

W. H. Bleecker, Jr., district sales manager at the Chicago office of the Page Steel & Wire Company, New York, has been transferred to the New York office in the same capacity, and **E. J. Flood** has been appointed district sales manager for all Page products at the Chicago office, succeeding Mr. Bleecker.

A. H. Dodge has been appointed sales manager of the J. G. Wilson Corporation, New York City. **E. Doscher** has been appointed assistant sales manager and district manager for New York; **S. H. Monsces** has been appointed general sales correspondent and **H. S. Tompkins**, formerly of the Western Electric Company, will specialize on Diffuselite fixtures.

William Aldrich, who has recently been in charge of thermit welding in the Southern territory of the Metal & Thermit Corporation, New York, has been transferred to the Western territory. **William H. Moore**, who recently was assigned to the Chicago territory, now has charge of the Southern territory. The San Francisco offices of the corporation have been removed from 329-333 Folsom street, to the new South San Francisco plant.

John B. Seymour, district sales manager of the Verona Tool Works at Chicago, has been appointed sales manager of the Superior Supply Company, 5 South Wabash avenue, Chicago. The officers of this company, which was organized recently, are: President, **Will R. Sostheim**, formerly director and manager of the railroad, contractor and machinery department of George B. Carpenter & Co.; vice-president, **E. A. Kreplin**, formerly purchasing agent of that company, and secretary-treasurer, **John H. Erby**, formerly Detroit district manager of the same company.

Henry T. Gerdes, mechanical engineer and manufacturer of New York, has been elected president of the Hauck Manufacturing Company, Brooklyn, N. Y. The other officers of the company are: **M. C. Hauck**, first vice-president; **A. B. Hauck**, second vice-president; **H. H. Kress**, third vice-presi-

dent; **A. H. Stein**, treasurer, and **J. Lutz**, secretary. Mr. Gerdes, who succeeds the late Arthur E. Hauck as president, is a graduate of Stevens Institute of Technology. He was for many years manager of the Treadwell Engineering Company, Easton, Pa., and has a practical knowledge of the manufacture of oil burning torches and appliances.

Alexander H. Handlan, president of the Handlan-Buck Manufacturing Co., St. Louis, manufacturer of railroad supplies, died recently at his summer home in Oconomowoc, Wis., from heart disease after an illness of more than a year. He was 77 years old, and retired from active participation in the company's affairs about 20 years ago. Mr. Handlan began his career 52 years ago as a bookkeeper for M. M. Buck, a small dealer in railroad lanterns. He bought an interest in the business shortly afterwards, and finally became the owner, changing the name in 1901 to its present form.

Will H. Bloss, manager of the steam railroad sales of the Ohio Brass Company, died suddenly of heart failure at his home in Mansfield, Ohio, June 22. Mr. Bloss was born April 4, 1869, and received his engineering training at the University of Indiana. At one time he was division engineer of the Atchison, Topeka & Santa Fe, later becoming chief engineer of the Indiana Union Traction Company, and was then connected with the Buda Company of Chicago. On November 16, 1906, has was appointed district sales manager of the Ohio Brass Company in the central states, which position he held until about a year ago. Since that time he has devoted his efforts to electrification development and other steam railroad problems.

TRADE PUBLICATIONS

Hoisting Equipment.—The Dake Engine Company, Grand Haven, Mich., has recently issued a new catalogue of its complete line of products, air and steam motors, hoisting equipment, steam boilers, etc., this catalogue comprising 72 pages, attractively arranged and bound. The catalogue is devoted chiefly to describing and illustrating the steam or air operated motor as an integral part of various hoisting equipment, blower fan, centrifugal pumps, etc.

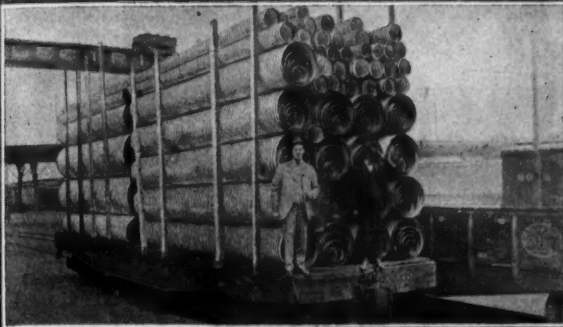
Locomotive Cranes.—The Browning Company, Cleveland, Ohio, has issued a catalog of 48 pages, 9 in. by 12 in., elaborately illustrated. The catalog contains descriptions of the details of construction of the various units entering into the crane, with data regarding the capacities, clearances and dimensions. It also contains a large number of photographs showing the crane engaged in a wide variety of operations on the railways and elsewhere.

Surveying Instruments.—The Warren Knight Company, Philadelphia, Pa., has prepared a 32 page booklet on its line of Sterling transits and levels. The booklet illustrates and describes the various parts and models of these instruments and lists its line of attachments and other surveying equipment which it carries.

Centrifugal Pumps.—The Dayton-Dowd Company, Quincy, Ill., has recently issued a descriptive catalogue of 20 pages on its line of centrifugal pumps, in the manufacture of which the company devotes its entire attention. This catalogue is bulletin No. 244. In addition to the information on these pumps, the catalogue contains several tables of useful hydraulic information.

The British Railways will be returned to their owners by August if a bill recently introduced in the British House of Commons by the minister of transport is approved. The bill is unique in providing for a consolidation of the roads into groups of non-competitive systems. The bill also provides for the establishment of an elaborate commission known as the Railway Rates Tribunal, which will be given authority over all charges. All labor disputes are to be referred first to joint conferences in each group, thereafter to a central wage board, thence, in the event of an appeal, to the National Wage Board. On the latter board the public will be a third party. Some opposition to the bill is expected from the labor interests owing to the fact that labor is not to be represented on the board of directors.

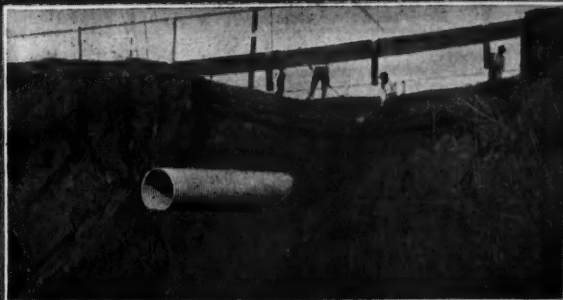
Armco Culverts



Economy of Transportation—Some conception of the economy of transporting Armco Culverts may be gained from the photograph to the left which illustrates a method of loading. This flat car contains 261 Armco Culverts ranging in diameter from 8 to 36 inches and having a total length of 4,470 feet. The weight, including 75 connecting bands, is only 60,495 pounds.



Easy to Carry—In smaller sizes and reasonable lengths, Armco Culverts may be carried by one or two men. The view to the left shows a man easily carrying a section of Armco Culvert 18 inches in diameter and 14 feet long. When larger diameters and greater lengths are to be moved into position, they may be rolled by a few men.



Easily Installed—No heavy, cumbersome and costly machinery is required for the installation of Armco Culverts. In numerous instances it is only necessary to dig a trench and roll the culvert in place. At times when it is not permissible to dig a trench across railroads or important highways, a tunnel may be dug under the road-bed and the culvert inserted.



Permanence Assured—The chemical purity, homogeneous texture and heavy galvanizing of Armco Ingot Iron, from which Armco Culverts are made, enables them to resist rust and the deteriorating action of soil or climate. The installation shown here was made under a dirt road in 1911—paved over as a permanent installation in 1913—and in perfect condition today.

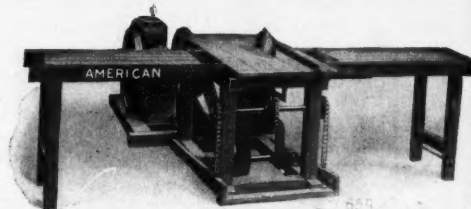


There is a manufacturer in nearly every state, and in Canada, making genuine rust-resisting ARMCO CULVERTS and other products of Armco Ingot Iron such as flumes, siphons, tanks, road signs, roofing, etc. Write for full information and nearest shipping point on products in which you are interested.

ARMCO CULVERT & FLUME MFRS. ASSN.
215 NORTH MICHIGAN AVE.  CHICAGO

AMERICAN SPEED MAKERS

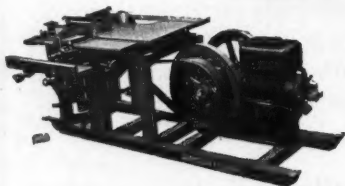
Help build the Big Dempsey-Carpentier Fight Arena covering 30 acres of typical New Jersey meadows.



AMERICAN
Speed Makers
are found on most
hurry up construction
jobs. Self
contained, easily
moved—
always de-
pendable.



Ask for
Bulletin No.
77 describing
AMERICAN
Contractors'
Woodworking
Machinery.



Photograph shows American SPEED MAKER and men feverishly at work. Three machines on the job. All CHAMPIONS with the punch necessary to win out in every endurance contest. Always ready at the word "GO" and just as strong at the finish.

AMERICAN SAW MILL MACHINERY CO.
140 Main Street, HACKETTSTOWN, NEW JERSEY

"NATIONAL" THE BETTER CULVERT PIPE



Strength and durability are necessary to withstand the influences that the elements bring to bear upon any culvert pipe.

Strength and durability are characteristics of cast iron—that is why it was chosen for the manufacture of

"National" Lock Joint Pipe

It is also the reason for fifteen years of service without a failure and for reckoning the life of "National" culverts in centuries.

Recent price reductions have placed "National" pipe at a figure which is very close to pre-war level.

WHAT ARE YOUR REQUIREMENTS?

AMERICAN CASTING CO.

Birmingham, Ala.

Chicago Office - Peoples Gas Bldg.

Fred A. Houdlette & Son - New England Representative Boston, Mass.

H. P. Webb - St. Louis Representative Wainwright Bldg.

St. Paul Office - Contractors Supply Equipment Co.



Diamond Fibre the Universal Raw Material

Track and Signal Insulation That Gives Competent Service

Good, clean fibre, Yes! But, more specifically, first class railroad fibre. That's why the big roads choose Diamond fibre. It not only meets standard specifications—it exceeds them because it is made upon formulas based upon prolonged actual service tests.

Extreme purity gives it top-notch insulating qualities. Exceeding toughness, great strength and extreme hardness make it "a bear for wear." You can bank on it. It lessens upkeep.

Diamond State Fibre Company

Bridgeport (near Philadelphia), Penna.

Branch Factory and Warehouse, Chicago

Offices in Principal Cities

In Canada, Diamond State Fibre Co. of Canada, Ltd., Toronto



Scientific Methods

Are Used in the Manufacture of

HIPOWER NUT LOCKS

Only by the use of such exacting methods as are illustrated below can the uniform excellence of Hipowers be guaranteed.

The entire heat treating process of Hipowers from the original hardening to the final tempering is accurately checked by Duplex Recording Pyrometers and Thermometers, thus totally eliminating all judgment of operator.

Human judgments are liable to vary—scientific methods are absolute.

That's why Hipowers are the recognized standard means of maintaining the bolted security in the track joints of the world's best railroads.

THE NATIONAL LOCK WASHER CO.

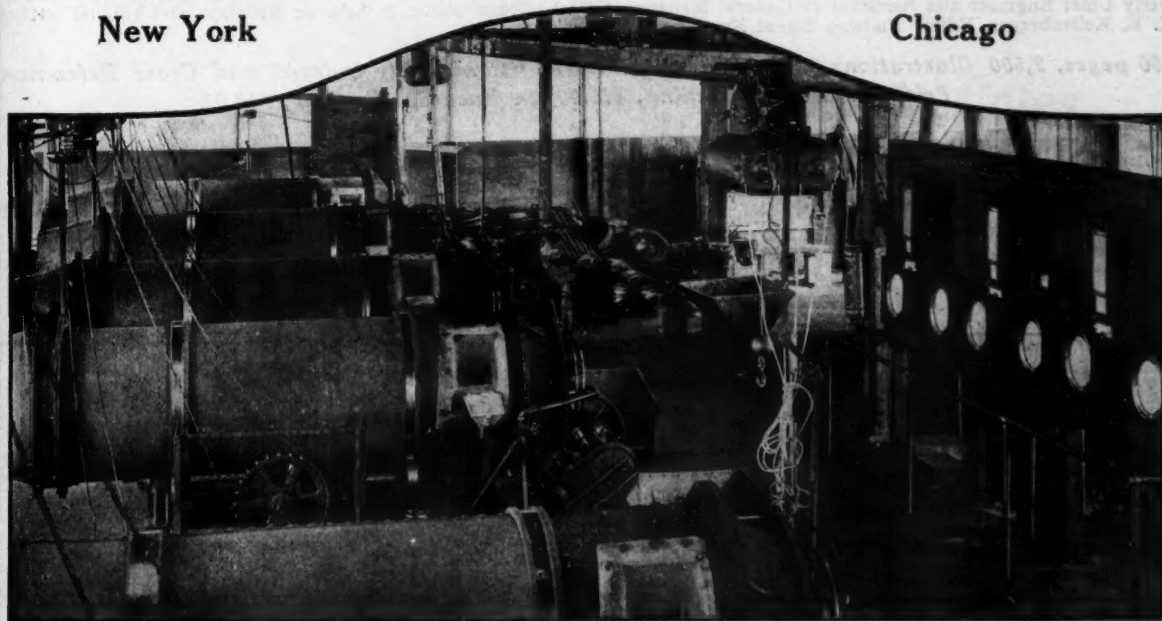
Newark, N. J.

Established 1886

Detroit

New York

Chicago



Are You A Maintenance Man?

A man may be a competent officer in some maintenance department, and yet, as a maintenance officer, meet any day some new kind of problem arising from the contact of his own department with some other.

One may be a good track man, and yet not know much about bridges; a good superintendent of bridges and buildings, and yet have much to learn about water service; while the signal officer comes in daily contact with the physical equipment and operations of other departments of which he must have additional knowledge in order to become a competent officer.

The real maintenance man knows not only one department intimately, but has a working knowledge of the operation of other associated departments.

There is no department of railway service that is not dependent upon or influenced by the necessities of some other department. The branches of the same department are even more intimately connected. The specialist may know his own branch thoroughly, but if he knows or cares nothing about the branches whose proper functioning overlaps his own, he has learned only a part of his lesson. He is not on the way to make a maintenance man.

A work designed, among other things, for the very purpose of helping maintenance of way men across this "no-man's land" by furnishing them concise information about associated branches of the same department is now available.

MAINTENANCE OF WAY CYCLOPEDIA

A Maintenance of Way Library in One Volume

The Maintenance of Way Cyclopeda includes in one volume, in convenient form for ready reference, authoritative information upon all phases of its subject necessary not only to the Engineer of Maintenance of Way and his Assistants, the Supervisor, the Roadmaster, the Superintendents of Bridges, of Buildings, of Signals and of Water Service, but to the operating officer—the Division Superintendent, the General Superintendent, the General Manager and Executive Officers generally.

Edited by E. T. Howson, Western Editor Railway Age and Editor Railway Maintenance Engineer; E. R. Lewis, formerly Chief Engineer and Assistant to General Manager, Duluth, South Shore & Atlantic Railway; and (Signal Section) K. E. Kellenberger, Editor Railway Signal Engineer.

866 pages, 2,500 illustrations and numerous inserts. Completely Indexed and Cross Referenced.
Price, in Leather Binding, \$15.00; in Buckram Binding, \$10.00

SIMMONS-BOARDMAN PUBLISHING COMPANY

Woolworth Bldg., New York

Transportation Bldg., Chicago

Cleveland

Cincinnati

Washington

London

PLEASE FILL AND RETURN ONE OF THESE COUPONS

INFORMATION

SIMMONS-BOARDMAN PUBLISHING COMPANY
 Transportation Bldg., Chicago

Please send me further information regarding Maintenance of Way Cyclopeda and especially as to its value in helping me, as a (Track), (Bridge), (Water Service), (Bridge and Building), man, to become a Maintenance Man.

Name.....

Street.....

City.....State.....

Position.....Road.....

ORDER

SIMMONS-BOARDMAN PUBLISHING COMPANY
 Transportation Bldg., Chicago

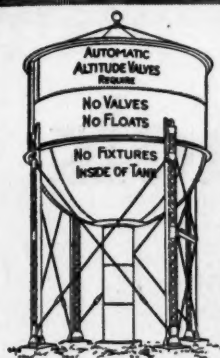
Please send me copy of Maintenance of Way Cyclopeda for which I enclose \$.....
 { Leather binding } ☐
 { Buckram binding } ☐

Name.....

Street.....

City.....State.....

Position.....Road.....



Keep a Uniform Stage of Water in Your Tanks

Stop wasting water and keep a constant head on your distribution system by equipping all reservoirs, stand pipes and tanks with **GOLDEN-ANDERSON PAT.**

Automatic-Cushioned Controlling Altitude Valves

- 1.—Insure uninterrupted service and a positive water supply at all times.
- 2.—Prevent waste due to over-flow.
- 3.—Contain no floats or fixtures.
- 4.—Absolutely cushioned by both water and air in opening and closing. No banging, water hammer or burst mains.
- 5.—Can be opened and closed from distant points by simple electric solenoid attachment if desired.
- 6.—Can be made to work both ways to close automatically on a single pipe line in case of a break.
- 7.—Heavy construction throughout.

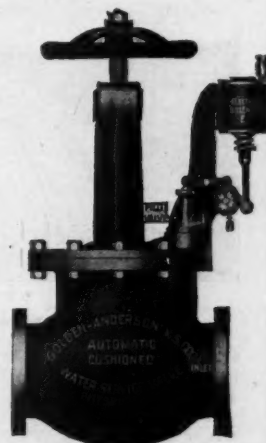


GOLDEN-ANDERSON Pat. Automatic-Cushioned Water Pressure Reducing Valves

- 1.—Maintain a constant terminal water pressure under all conditions.
- 2.—Positively cushioned by water and air in opening and closing.
- 3.—Valve closes slowly, eliminating all shock and water hammer.
- 4.—Can be furnished with electric feature to open valve to full area from distant points.

GOLDEN-ANDERSON Pat. Cushioned-Water Service Valve "FOR FIRE SERVICE"

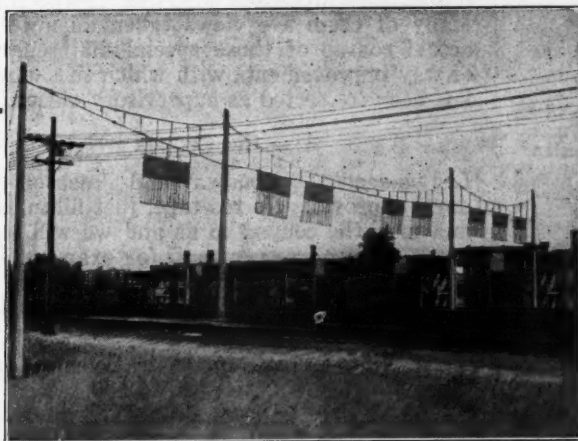
- 1.—Can be opened and closed instantly from distant points by electricity.
- 2.—Current is on only a few seconds, thereby preventing waste.
- 3.—Can be fitted with either d.c. or a.c. solenoid.
- 4.—Perfectly cushioned by water and air. Positively no metal to metal seating.
- 5.—Can be closed by hand.



"HOSTS OF REFERENCES"

Golden-Anderson Valve Specialty Company

1290 Fulton Bldg. Water and Steam Specialties Pittsburgh, Penna.



Concrete Poles for Bridge Warnings

Massey Hollow Reinforced Concrete Poles readily adapt themselves as supports for bridge warnings.

Made by a special centrifugal process—they are light and have all the strength of steel poles, combined with the permanence, rigidity and lack of maintenance expense which characterize reinforced concrete.

Massey Concrete Products Corporation
Peoples Gas Bldg., Chicago

New York
50 Church St.
Dallas
Sampter Bldg.

Pittsburgh
Oliver Bldg.
St. Louis
Ry. Exch. Bldg.

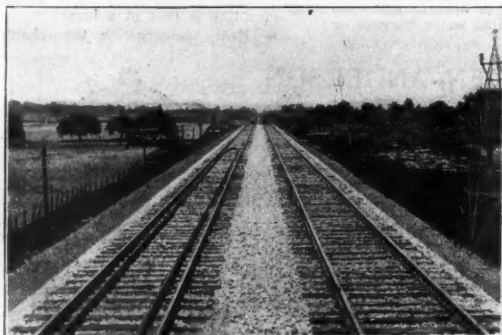
Atlanta
Candler Bldg.
Salt Lake City
925 S. 6th St., W.

Have You Seen This Book?

Roadway and Track

By W. F. RENCH, Civil Engineer

If Not—It Will Cost You *Nothing* to Examine It



Labor-Saving Methods

Labor-saving devices and methods are receiving increased attention in maintenance of way work on all roads to-day. The employment of machines where possible is desirable also to avoid the many minor accidents. The broad provisions of workmen's compensation laws make it imperative that the roads shall strive earnestly to reduce the number and seriousness of such accidents.

Use of Tools

The correct choice, care and use of small tools are also important, not only in increasing efficiency, but in promoting the safety with which such work shall be done. The proper selection and use of tools will result in a marked saving in the expenditure for new tools and an increase in the output of the section forces.

Program of Work

The organization of the working forces for the repair of either roadway or track is an important element for progress along economic lines and deserves careful attention. Track work, such as ballasting and rail laying, is developed to as nearly a perfect system as possible. A study of the individual case will determine its proper conduct, but many points are given which will aid in reaching a solution. The book includes a suggested program for M. W. & S. work. A careful survey of this program will convey helpful suggestions, and so, indeed, will every other chapter in this necessary work.

**Simmons-Boardman
Publishing Company**

Book Service Dept.

Woolworth Bldg., New York, N. Y.

"The House of Transportation"

A QUARTER of a century's practical experience plus an extended study of the subjects treated are summed up for you in *Roadway and Track*. Here is a partial list of chapter headings.

The Right of Way
Drainage of Roadbed and Track
Vegetation for Banks
Labor Saving Devices and Methods in Roadway Work
Economics of Roadway
A Program of Maintenance of Way and Track Work
Tools and Their Uses
The Track Obstruction
Labor-Saving Devices and Methods in Track Work
Practice in Renewal of Rail
Maintenance of Main Tracks
Economics of Track Labor
Maintenance Problems and Methods Used
Special Duties in the Maintenance of Way Department

These headings serve to show how thoroughly the subjects of railway and track are covered.

Some forty plates are included which were selected with the one purpose of illustrating the various processes described in the text. Many of them are views taken during the actual course of those special maintenance of way improvements with which the author has been connected as supervisory officer.

Use the Coupon

Let us send you *Roadway and Track* on ten days' approval. No red tape, just fill in, clip and mail the coupon to us and we will send you a copy by return mail for examination. Look it over carefully and if you decide to keep it, mail us \$3.00, otherwise return the book to us.

250 Pages. 40 Illustrations.
Size 6 x 9 inches. \$3.00.

10-Day Approval Coupon

Simmons-Boardman Publishing Co.,
Book Service Department,
Woolworth Building, New York, N. Y.

Please send me on approval a copy of *ROADWAY AND TRACK* by W. F. Rensch, C. E., priced at \$3.00. I will remit \$3.00 in payment or return the book to you within ten days after its receipt.

Name

Address

City State

M^r. Position R. R.



It will do as much ditching in a day as 60 to 150 hand laborers

Hand gangs aren't all alike; and ditchers are not alike; sometimes one gang of 60 men will dig as much ditch as another gang of 150. But all "AMERICAN" Railroad Ditchers are alike; every one of them will dig at least as many lineal feet of ditch a day as a gang of 60 top-notch shovelers.

That's the beauty of the "AMERICAN"; it is consistent and dependable. It will ditch in muck and gumbo that would paralyze a hand crew. It will dig a wide ditch or a narrow one deep or shallow; lose less time clearing for trains, and show more results for every ten-hour session "on line" than the best hand crew that ever was mobilized.

The Georgia & Florida Ry. ditched a number of "calico clay" cuts with one of their "AMERICANS" and got by for 8.3 cents a yard. If you have ever seen "calico clay" you can appreciate just what a feat this was.

We want your inquiries. An "AMERICAN" representative can reach you in twenty-four hours.

"Give me where I may stand and I will move the world"

American Hoist & Derrick Co.
Saint Paul Minnesota

Builders of "AMERICAN"

Hoisting Engines	Locomotive Cranes	Sugar Cane Machinery
Electric Hoists	Railroad Ditchers	Marine Deck Machinery and Tackle
Derricks	Logging Equipment	The Genuine "CROSBY" Wire Rope Clip

New York Chicago Pittsburgh Seattle New Orleans Detroit

AMERICAN
HOIST & DERRICK CO.

Aeron System Portable Painting Equipment

Painting Equipment for Real Service

GETTING MORE AND BETTER WORK DONE with fewer workmen, or in less time, is accomplished with Aeron spray-painting equipment.

This REAL SERVICE is to be had on bridge or structure painting along the right of way as on any other painting of the maintenance department.

Let us place before you Aeron operation and equipment facts—they point the way to a solution of most painting problems.

The DeVilbiss Mfg. Co.

3682
Detroit
Ave.



Toledo,
Ohio



Automatic Air Lift Supplies P. & R. Engines



THE station agent at Telford, Pa., starts and stops this Sullivan tank pumping installation, 3600 ft. distant.

The well, compressor, re-lift booster, etc., are in the building shown above, which is 536 ft. from the 75,000 gal. tank.

Capacity of plant, 100 gals. per minute.

For details, see May Maintenance Engr.
Bulletin 1971-D

SULLIVAN MACHINERY CO.

411 Gas Bldg.

CHICAGO



RAMAPO
AUTOMATIC SAFETY SWITCH STANDS

Switches, Frogs,
Guard Rail Clamps,
Industrial Cars, etc.
Manganese Track Work a Specialty

Ramapo Iron Works
HILLBURN, NEW YORK
Plants at Hillburn, N.Y. and Niagara Falls, N.Y. New York Office, 30 Church Street

Specialists in the Design and Manufacture of
**Standard—Insulated—Compromise
Rail Joints**

The Rail Joint Company, 61 Broadway, New York City

ESTABLISHED 1882

THE WEIR FROG CO.

Track Work of Rail and
Manganese Steel Construction

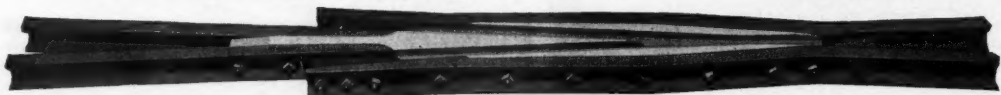
Manufacturers of Balkwill Articulated Cast Manganese Crossings

CINCINNATI

OHIO

SPECIAL TRACK WORK

MANGANESE STEEL AND PLAIN RAIL
CONSTRUCTIONS



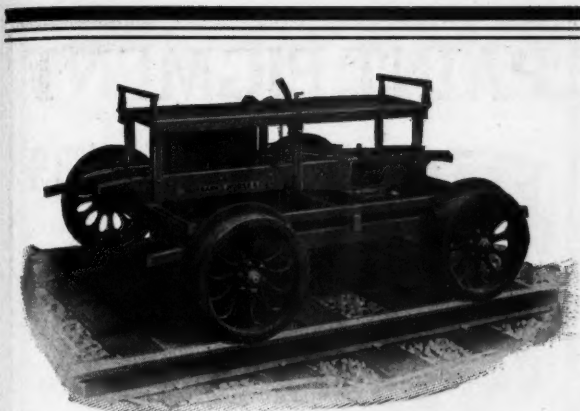
A. R. E. A. Standard No. 10 Railbound Manganese Steel Frog.

Originators of the Use of Manganese Steel in Track Work

WM. WHARTON JR. & CO., Inc.,

EASTON, PENNA.

Subsidiary of Taylor-Wharton Iron & Steel Co., High Bridge, N. J.



Always Ready for a Quick Trip—Light, Economical and Safe

Fairbanks-Morse

Sheffield

41

CENTER LOAD CAR

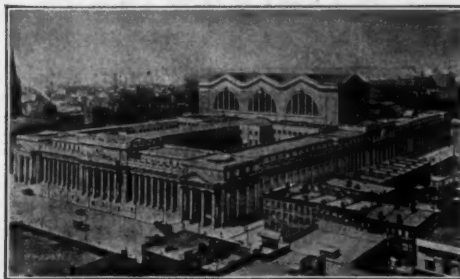
This safe center load car is the trusted assistant of hundreds of inspectors, maintainers, roadmasters and signal men on all the leading railroads. They use it for every day service—find it light, simple, and convenient to operate. A steady, even running, easy riding car.

The "41" has a horizontal, two cylinder, two cycle air cooled engine operating on kerosene as well as gasoline. Engine has only five moving parts—crank shaft, pistons and connecting rods. Air cooling does away with water trouble. Automatic primer gives easy starting in all weather. Separate sills support engine—this prevents strain on driving axle.



Fairbanks, Morse & Co.
MANUFACTURERS CHICAGO

Oil Engines - Pumps - Electric Motors and Generators - Fairbanks Scales - Railway Appliances - Farm Power Machinery



PENNSYLVANIA TERMINAL, NEW YORK, N. Y.
McKim, Mead and White, Architects

Lower Maintenance Costs

Whether it is for a tool house or for the Biggest Railroad Terminal in America—there is a list of "R. I. W." Protective Products that is considered essential by most engineers.

R.I.W. PROTECTIVE PRODUCTS
REMEMBER IT'S WATERPROOF
REG. U.S. PAT. OFF.

include materials for damp-proofing exposed brick walls; stain-proofing marble, granite and other cut stone; materials for water-proofing concrete work, stucco, cement mortar, etc.; also priming and finishing coats on steel or other metal subjected to the elements or to various corrosive conditions.

"R. I. W." Protective Products protect the largest terminals, the longest bridges, the highest buildings, the deepest tunnels.

Write for Specific Details.

Address Eng. Dept.

TOCH BROTHERS

Technical and Scientific Paint and Varnish Makers Since 1848

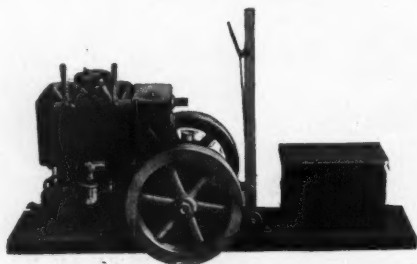
320 Fifth Avenue NEW YORK

Works: Long Island City, N. Y.

R.I.W.
REMEMBER IT'S WATERPROOF
REG. U.S. PAT. OFF.

STEEL NEED NOT RUST!
WOOD NEED NOT ROT!
NOR CONCRETE DUST!

"Road Boss"



For reliability, economy and efficiency the 4 cycle type of engine is supreme. That is why, without exception, all automobiles, tractors, trucks, aeroplanes and stationary engines are of this type.

Put your section car in this class by equipping it with a "ROAD BOSS" 4 cycle, 4 H. P. reversible engine. A substantial reduction effective May 1st; price includes complete equipment ready to mount. Can be furnished in either "ball" or "Liberty Motor" babbitt bearings.

Write for descriptive matter.

North American Engine Co.
Dept. ME. ALGONA, IOWA

PAINT PIGMENT



DIXON'S Silica-Graphite PAINT

A paint pigment, to do effectively the work for which it is intended, must have certain vital properties, some of which are:

- 1.—It must be inert—that is, it shall not undergo any chemical change in use.
- 2.—It must aid in preserving the original elasticity of the vehicle.
- 3.—It must increase the thickness of the paint film to afford better protection.
- 4.—It must have long life to maintain unimpaired the above properties.

All of these conditions are met fully by flake silica-graphite, the pigment used in Dixon's Silica-Graphite Paint. This pigment is mined naturally combined and therein lies the secret, for experience has shown that a mechanical mixture will not perform these vital functions.

Write for our Technical Booklet No. 187-B. It will show how and why silica-graphite is better pigment.

JOSEPH DIXON CRUCIBLE COMPANY



Jersey City

Established 1827

New Jersey



ST. LOUIS FROG AND SWITCH CO. TRACK WORK OF QUALITY



Manufacturers of Balkwill Articulated Cast Manganese Crossings

We are pleased to send our 280-page Catalogue on request.

Address Dept. M, St. Louis, Mo.

Classified Advertisements

Use this section when seeking a new man, a new position, or when buying or selling second-hand equipment.

Rate is 5c a word a month. Minimum charge, \$1.00. Remittance must accompany each order. Address

Railway Maintenance Engineer

Classified Advertising Department

608 South Dearborn Street, Chicago

EDUCATIONAL—Roadmasters, supervisors, engineers, foremen, office men, track laborers—Get a broader knowledge of track work and railroading in general. Learn more about *the other side* of the business. Technical instruction for the practical track man—practical information for the technical graduate—a selected course of study to fit **your** needs. \$1.50 per month covers all expense. Our free special bulletin tells all about it. Address The Railway Educational Bureau, Omaha, Nebr.



DES MOINES RAILWAY SERVICE TANKS

You men of the Maintenance Department know the utter futility of trying to "maintain" an article that will not stay "put"—know that true economy is attained only when the article fulfills its mission better than any other article of the same class.

That's why Des Moines Railway Service Tanks have been advertised to you—and that's why, also, so many of our railroads have standardized on Des Moines Tanks.

If you are interested in cutting your water service maintenance costs, write for catalogue 42—it's free.

Pittsburgh-Des Moines Steel Company

842 Curry Building

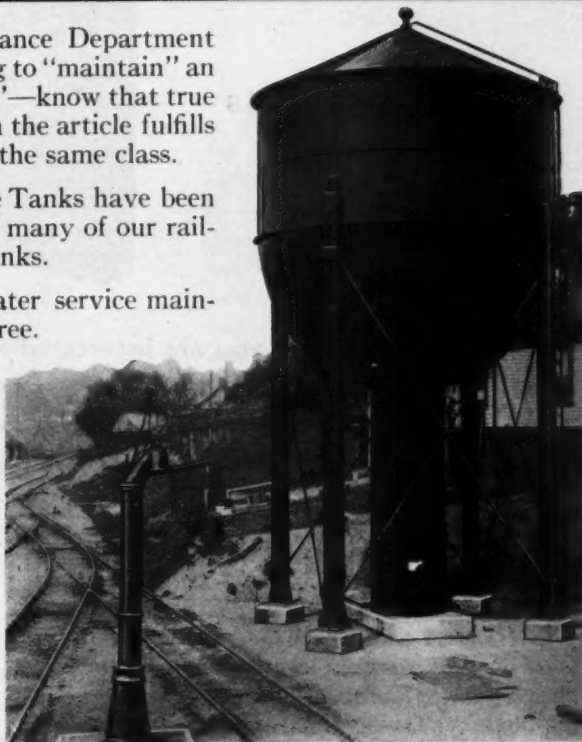
Pittsburgh, Pa.

NEW YORK, 242 Hudson Terminal
CHICAGO, 1242 1st Nat'l Bank Bldg.
DETROIT, 1142 Book Building

WASHINGTON, 942 Munsey Bldg.
SAN FRANCISCO, 342 Rialto Bldg.
DALLAS, 1242 Praetorian Bldg.

DES MOINES PLANT AND OFFICE:
942 Tuttle Street, Des Moines, Iowa

CANADIAN PLANT and OFFICES: Canadian Des Moines Steel Co., Ltd.
242 Innes Ave., Chatham, Ont. 70 St. James St., Montreal, Que.



DES MOINES

The Stowell Company

FOUNDERS AND MANUFACTURERS

South Milwaukee,

Wisconsin

"Certified" Malleable Castings Electric Steel Castings

Castings made, handled and tested in accordance with rigid and scientific methods.

Mail us your inquiries

RU-BER-OID ROOFING

The original asphalt ready-to-lay roofing. Made from the same formula for over 28 years.

Smooth surfaced, fine talc dusted finish. Special large-headed sherardized (zinc impregnated) nails and Ru-ber-ine Cement in each roll.

Ru-ber-oid Roofing wears longer than ordinary prepared roofings, therefore, most economical.

RU-BER-OID UNIT-SHINGLES

Green or red, slate surfaced, 8"x15¼", 5 inch exposure.

Ru-ber-oid Giant and Hercules Building Papers

Other Railroad Products

Ru-ber-oid Burlap Plastic Roofing
Impervite for Cement-Waterproofing
Flexite Metal Preservative Paints
S P C Graphite Paints
S P C Cement Floor Paints and
Masonry Finishes
P & B Acid Resisting Paints
P & B Insulating Compounds
P & B Insulating Tape

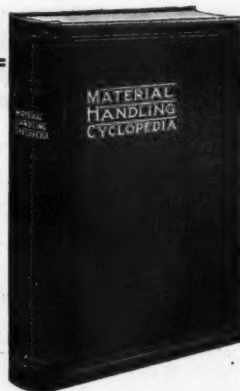
THE RUBEROID COMPANY

Formerly The Standard Paint Company

95 Madison Avenue,
CHICAGO

New York
BOSTON

Now Ready



Cut Your Costs

This Tells How

If you are interested in moving materials

Material Handling Cyclopedia

was written for you

TO you maintenance engineers and executives who have to do with the use of **transference** machinery, the 1921 MATERIAL HANDLING CYCLOPEDIA will render a signal service. All sorts of devices used in construction and maintenance work are thoroughly covered in each section of the book. Cranes, Hoists, Winches, Derricks, Excavators, Buckets, Steam Shovels, Scoops, Magnets, Car Loading and Unloading Equipment, Tying Machines, Tractors and Trailers. These are just a few of the subjects treated in this book.

A Century and a Half of Experience

THE 1921 MATERIAL HANDLING CYCLOPEDIA contains a wealth of practical information to help you with every one of your material handling problems. And this information has been written and edited by men who know the field; who are specialists in the study of **efficient handling methods**. Their work, as executives, in dealing with transference machinery application totals a period of 151 years. The best methods developed during their combined experiences are clearly set forth in Material Handling CYCLOPEDIA. Clip and mail the coupon now.

Definition Section—150 pages

Gives terse, clear-cut definitions of the principal terms used in connection with material handling methods and equipment and brief descriptions of the mechanism of the various devices.

Technical Section—550 pages

Treats of the types of material handling machines, under main classified headings. The structural design of each machine is described in detail and its uses comprehensively explained. Transference principles are discussed at length, showing the advantages of the different devices for certain lines of work. Over 1500 carefully chosen photographs, together with hundreds of line drawings, charts, curves, etc., render the text easily and readily understood.

Catalog Section—150 pages

Enlarges and completes the other two sections. Leading manufacturers illustrate and describe their own products and point out particular advantages of these devices for the various branches of industrial service. The products represented are also grouped according to the nature of service they perform. These 150 pages of live cost data prove indispensable to the user when buying new equipment.

Other Important Features

All related data in each of the three sections is cross referenced in such a way that the user can find any information he needs at a moment's notice. For ready reference he has a Directory of Products, a Trade Name Index, and an Alphabetical Index of Manufacturers.



Please cross off binding you do NOT desire.

Simmons-Boardman Publishing Co.,
Book Service Department,
Woolworth Bldg., New York City.

Enclosed find ☐ check ☐ order for \$..... Please send me prepaid a copy of
Material Handling Cyclopedia in ☐ Cloth binding \$10.00
☐ Leather binding 15.00

Name.....

Address.....

Town....., State.....

R. R. or Co.....

Position.....

New Century Switch Stands



For yards, terminals, and high speed main line service—a model for every condition—mechanically correct—adjustable throw—only certified materials used—large production with perfect interchangeability of parts—carried in stock for quick shipment.

Catalogue on Request

"Easy to Throw"

BETHLEHEM STEEL COMPANY

General Offices: BETHLEHEM, PA.

Sales Offices:

NEW YORK
BOSTON

PHILADELPHIA
BALTIMORE

WASHINGTON
ATLANTA

PITTSBURGH
CLEVELAND

DETROIT
CHICAGO

ST. LOUIS
SAN FRANCISCO

SOLE EXPORTER OF OUR COMMERCIAL PRODUCTS **CONSTEEL** CONSOLIDATED STEEL CORPORATION 25 BROADWAY, NEW YORK, U.S.A.

A SPREADER THAT PLOWS



Front View of the Bucyrus Spreader Plow in Action, Shouldering and Ditching in One Operation.

The Bucyrus Spreader Plow

is heavier, stronger, and more massive in construction than any similar machine ever built (weight 70 tons, 60% steel castings).

Has successfully plowed and spread heavy frozen clay, frozen iron ore, boulders, etc., material never before attempted by any spreader.

It has a greater operating range than any spreader built.

It will build embankments to any height in 7-ft. lifts; thus eliminating need of expensive trestles.

With ditching attachment it will cut ditches to predetermined dimensions.

All operations air controlled—quicker, simpler adjustments.

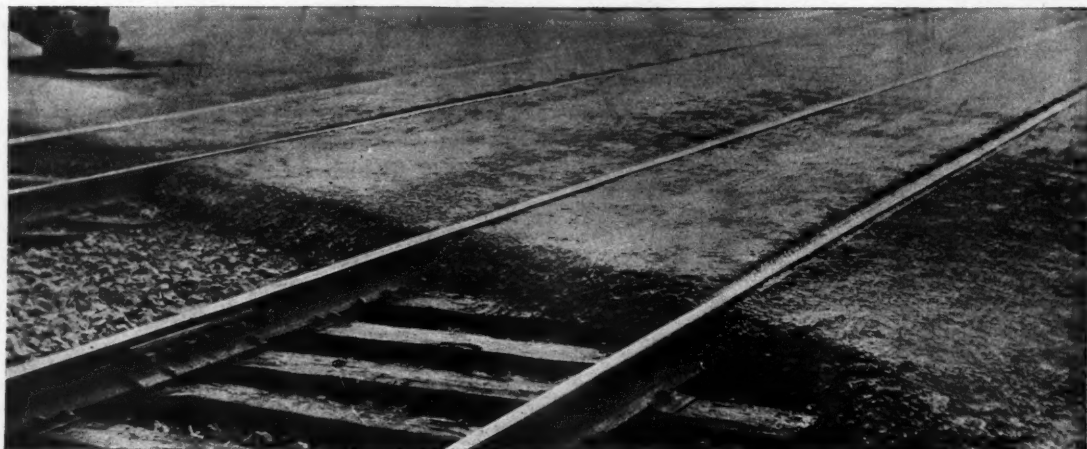
Send for Bulletin SP-D.

New York
Chicago
Minneapolis
Birmingham
Cleveland
Denver

BUCYRUS COMPANY
SOUTH MILWAUKEE, WIS.

San Francisco
Portland, Ore.
Pittsburgh
Richmond, Va.
Salt Lake City
London, England 313

Headley Number 1



HIGHWAY GRADE CROSSING— Bituminous

WRITE FOR PARTICULARS AND BOOKLETS

HEADLEY GOOD ROADS CO.

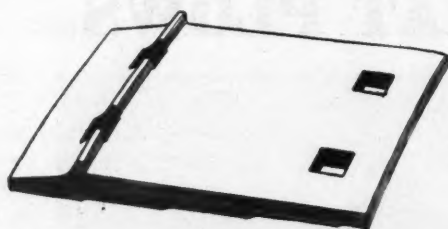
Franklin Trust Building,

St. Louis, 1946 Railway Exchange Bldg.
Chicago, 179 W. Washington St.

BRANCH OFFICES:

Philadelphia, Pa.

West Medford, Mass., 37 Prescott St.
Indianapolis, Ind., 911 Hume-Manseur Bldg.



The Lundie Tie Plate

The Lundie Tie Plate is widely acknowledged by railroad men having such plates in track, as promoting decided economy in rail wear, in holding track to gauge and in giving easy riding track. It will far more than pay for itself in reduction of Operating Expenses.

The features of the plate are—a sloping seat inclining the rail, so reducing abrasion and internal stresses in the rail to a minimum—a true camber promoting easy riding—and a bottom, as shown in the cut, so seating itself on the tie that the track is held firmly to gauge without injury to the tie.

The combination of these features, or their mechanical equivalent, is covered by Letters Patent, supported by other Patents covering certain individual features of the plate. Railroad companies pay no royalties on its authorized use.

The Lundie Engineering Corporation

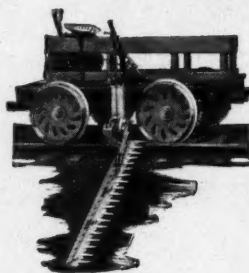
920 Broadway, NEW YORK

Chicago Office, 30 North La Salle Street

CUT DOWN EXPENSES— SAVE YOUR MEN'S TIME

for other work, by using

RAWLS TRACKMOWER



An attachment for Motor, Hand, or Push car, Operated by Section Men.

Cuts grass and weeds in one-twentieth of the time required by the old-fashioned scythe.

IN USE ON 33 ROADS

(Watch this number grow)

**We Specialize in Trackmowing
Equipment Only**

Rawls Machine & Manufacturing Co.

1412 N. Halsted Street

Chicago, Ill.

Representatives: S. E. Rawls, Elwyn B. Orr, Russell King

Cable Address: Rawlsmachy.

Codes. A B C, 5th Ed. and Private



A Rolled Steel Step Joint—

Technically correct in theory and of demonstrated efficiency, the Q & C Rolled Steel Step Joint represents the highest development in track splicing. Under heavy loads and high speed outlasting the life of the rail, this formidable joint stands supreme.

Being made of open hearth rolled steel annealed, and strengthened by the Q & C Bonzano design, with depending flange, they make the track where the two unequal sizes of rail are brought together even stronger than the heavier rail itself.

Q & C Rolled Steel Step Joints can be furnished to join any standard sections of "T" rail made. Specify them in your spring requisition. Blue prints and literature gladly sent on request.

THE Q & C CO.

90 West St., N. Y.

Chicago

St. Louis

San Francisco

VERONA TRACK WRENCH



DROP FORGED, TEMPERED
AND DESIGNED TO ELIMI-
NATE WEAR, SPREAD AND
BREAKAGE OF JAWS.



The shape of a
Verona Tool may
be copied, but not
the Quality or the TRADE MARK

VERONA TOOL WORKS

PITTSBURGH

